ELECTRICAL WORLD

A consolidation of Electrical World, Electrical Engineer and American Electrician

What in the World!

Strange things happen these days. Inquiring as to the volume of business being done by one group of manufacturers, ordinarily eager for publicity, we were told: "Sorry, but we have decided to release no more bullish news until the labor situation quiets down." Perhaps the suppressed facts were bullish, who knows? One may always ponder upon the virtues of consistency, in any event.

●

"Who's Afraid of the Big Bad Wolf?" We find there are many—and the encouraging thing is that before long something may be done about it. Utilities will have to defend themselves vigorously, but we see victory if the fight is not delayed too long.

●

Light and power industry hopes lie chiefly in the operating executive who knows the property and the business from the beginnings and knows the human relationships involved. President F. R. Phillips of Duquesne Light emphasizes in this issue the mutuality of interest between and of public, employees and security owners. No plans that omit any of this triumvirate can be reasonable solutions for electric utility industry difficulties.

●

Modern marvels all too soon lose their ability to keenly astonish. Hot-working of 132-kv. lines, with risk reduced to a minimum and results superlatively satisfactory, readily becomes accepted as a matter of no great accomplishment. But successful transmission of 132-kv. itself was an astounding development in relationship to contemporary practice, not long ago, and the development of hot-line working technique and equipment was no mean achievement for any voltage.

●

There are interesting developments going on behind the scenes just now. Perhaps it will not be long before they come to light. One thing seems certain, however, and that is the extreme unlikelihood that business men are to take much more high-handed bossing without a struggle that may rock the ship.

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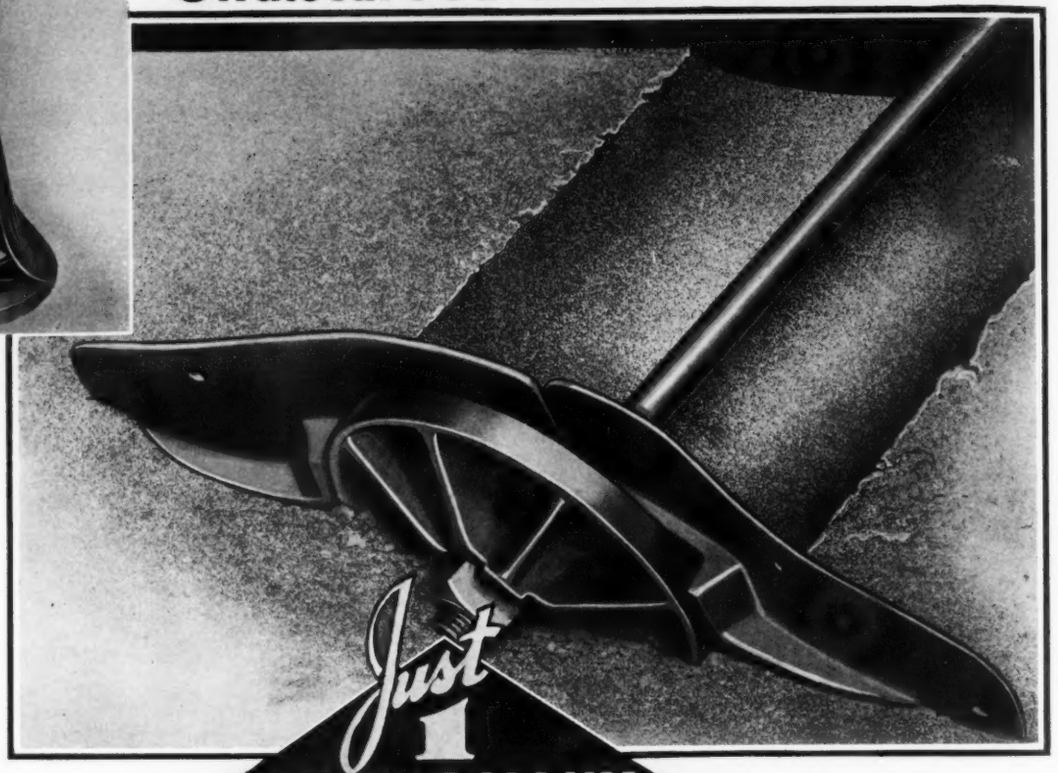

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ELECTRICAL WORLD

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October 7, 1933

L. W. W. MORROW, *Editor*

A Time to Defend Employer-Employee Rights

BEHIND the business scenes at present is a great half-hidden turmoil of strikes and disagreements, disappointments and discord. Codes which were looked upon to do so much toward speeding industrial activity and insuring better worker-employer relations are actually leading in many instances to interrupted production and to resumption of industrial strife. So serious has the matter become that the National Electrical Manufacturers Association at its recent Cleveland meeting passed a resolution earnestly pledging allegiance to the NRA code signed in good faith, to be applied in both spirit and letter, by employer and employees alike. N.E.M.A. sees nothing less than the whole NRA program gravely imperilled by the march of events.

Reasons for the discord are not hard to find. Remedies are less evident. Idealistically working toward reduced unemployment, better working conditions and the maintenance and even extension of the American standard of living, the administration has clothed with new powers a national, all-industry organization—the American Federation of Labor. Long all-but-dead, this body has had infused into it such vitality and authority as exceeds the ability of local divisions to apply quickly in an intelligent manner.

Local and one-industry views now bring arbitrary ultimatums to employers. Do so and so or we call a plant strike. Walkouts are called in one plant to force action in others. Not to do this or that, employers are told, is a violation of NRA principles. Genuine threats, serious menaces to recovery; arising from the conflict between theory and practice and only to be solved by patience, understanding and intelligent defense.

Industry has made great and all-but-unbelievable sacrifices to meet the president's program. It has entered upon plans to spread employment and raise wages without half a prospect of seeing where the money necessary to increase payrolls is to come from. It has shown a high order of courage. It has yielded upon many accepted basic principles of the past. To take an unfair and easy advantage of business enterprise at such a time probably is not acceptable to the great body of labor. Agitators in the field, domination by union delegates, misunderstanding of what NRA pacts really mean, are the causes of today's apparent breaches of faith. A minority is bringing discredit upon the majority.

To meet the situation industry will have to raise its head a bit further and stick out its chin and stand up defensively for its rights if disaster is to be avoided. Now is no time to have recovery, whatever its basis, imperilled. There is, moreover, one guide to which one may cling under the circumstances and that is the much discussed section 7 (a) of the President's re-employment agreement and of the pursuant industry codes, for that is the basis of the plan on which action is being taken. It is time to stand up for the preservation of fundamental employer-employee rights and for reasonable application of agreed-upon rules. Unfairness is unfairness and injustice is injustice regardless of by whom or for whom the deed is done.

The engineers' dilemma

Many engineers have been asked of late why they are not replacing obsolete equipment with modern, more economical facilities. They are reminded that equipment prices will in all probability be higher—increasingly so when long-delayed rehabilitation gets under way.

Invariably their answers involve a financial problem that might as well be tackled now as any time, otherwise they will always be faced with the same predicament. For example, they say, "We have a big unretired investment in equipment which we cannot afford to scrap so long as it will serve its purpose," or "How can we increase our investment when fixed charges on existing investment already constitute our greatest burden?" or "How do we know but development in the art will make adoption of new equipment obsolete before we can retire it?"

All these comments point clearly to the fact that investments in facilities undergoing improvement or in which great development is possible have not been retired fast enough. Retirement reserves will have to be built up faster in the future to avoid continuance of this situation. In the case of utilities this can only be done by the help of regulatory authorities. Retirement reserves cannot be increased if revenues are squeezed down to the point where there is insufficient margin after deducting normal fixed and operating charges to pay a return that will attract investors in equity securities.

The second comment is closely allied to the first. Fixed charges show up largely as interest on bonded indebtedness. If bond issues for capital expenditures are continued in perpetuity, which virtually occurs whenever old bonds are retired merely by floating new bonds, the fixed charges will rise indefinitely and become unbearable. All bond issues ought to be gradually retired, not merely refinanced, about as fast as the facilities which they purchased become obsolete. Again, this cannot be done by utilities unless there is a sympathetic public.

The third comment of engineers can be largely answered if the foregoing conditions are rectified. It is not expected that engineers should or will be able to take advantage of every increment improvement. Some may justifiably be passed by. But to hold off on any rehabilitation which shows marked advantages just because there are possibilities that something yet unheard of will surpass it in economy or performance is to stagnate, and let benefits roll by uncollected. Such caution encourages more daring competitors.

Something to be done about it

As between working for the tax-collector or working for the sheriff there is little to choose. Yet that is the way the utility business appears to be headed. Taxed, legislated, driven by government competition, and deserted by customers who refuse to pay their bills, the living death of the street railway beckons as a none too alluring example of what may happen. Fortunately that is not the only possible outcome.

We must sell, say the commercial men. We must rebuild for further economies, say the engineers. We must bide our time, say holding company executives. Operating executives in whose hands the enterprise truly rests say little, openly, but they are thinking a lot.

Increased output offers the opportunity to reduce fixed charges per dollar of revenue. But thus to increase net income sufficiently can only be accomplished at a price. The price is that of extensive promotional effort and expense. The price is high. The successful outcome worth fighting for. Rebuilding means ultimate economies and opportunity to compete with other electrical energy supply. The cost is appalling, measured in terms of accelerated depreciation and new capital requirements. Yet it is the counsel of necessity. So financial executives say "Let the storm blow out; wait and see." And the operating executives wait but don't see. And the confusion becomes worse confounded.

For you can't stand still. And you can't wait while the storm eats at the foundations, and you know it to be doing so. You strengthen the pillars sufficiently to protect the structure or you may find it beyond all possible repair when the storm goes by. The time has come to do something and that something means taking counsel of the best heads in the industry. It means calling in some outstanding citizens and co-operating with government in a National Council which may and undoubtedly can, work in sincerity, honesty and fairness to preserve utility enterprise, investors' dollars and low-cost politics-free service for the nation; doing so through a policy plan on rates, valuations, taxes and competition.

THE WEEK

New River Case Dismissed From Court of Appeals

Maintaining that it had no jurisdiction in the case and that the district court was in error in accepting jurisdiction, the United States Circuit Court of Appeals this week reversed and remanded, with directions to dismiss, the famous case of the Appalachian Electric Power Company against members of the Federal Power Commission in the New River project litigation. In reality, the decision, which probably will be far-reaching, upholds the authority of the Federal Power Commission over projects sought by private power companies even if they are on non-navigable streams.

The court agreed with the viewpoint advanced by counsel for the commission in argument both in the Court of Appeals and in the District Court. The lower court decision of Judge Luther B. Way, of the District Court of Virginia (ELECTRICAL WORLD, April 8, page 436) was made on the merits of the case, upholding the constitutionality of the Power Commission Act and of the regulatory powers of the commission, but refused to accept the government's claim that the court had no jurisdiction over the action. This latter holding was declared in error by the Circuit Court of Appeals decision just rendered. Pointing out that the action really sought in the suit before it was not restraint of the defendants or removal of a cloud from title, but a declaratory judgment as to the meaning and constitutionality of certain sections of the Federal Power Act, and the validity of orders of the Federal Power Commission purporting to be entered under them, the court characterized this as "a judgment which could grant no relief against any defendant before the court."

The power commission hailed the court's decision as a distinct victory both for the law and its jurisdiction, Chairman Frank R. McNinch, declaring: "It is a great victory of nation-wide significance in support of the Federal Power Commission's authority which will facilitate the administration's program for the national development of power resources. The commission and all who are particularly interested in water power legislation and the administration of the power act, will be gratified by this important decision."

▼

Refrigerator Sales Up, Edison Institute Reports

August sales of household electric refrigerators in the United States totaled 95,413 units compared to 25,583 sold in August, 1932, and 68,465 in the corresponding month of 1931, the industry's peak year, according to the electric refrigeration bureau of the Edison Electric Institute.

Total sales for the first eight months of the year were 890,380 units, against 644,313 in the corresponding period of 1932 and 767,913 in the first eight months of 1931. The sales in the entire year 1932 were 769,695 units. These figures check with those for manufacturing reported by the refrigerator division of N.E.M.A. (ELECTRICAL WORLD, September 30, page 425).

There is a great vista opening up in the micro-wave spectrum. We have discovered that the tiny waves are not limited to optical distances; the curvature of the earth is no barrier. If we succeed in sending micro-waves over long distances we may revolutionize the whole art of radio. And I stake my reputation on it—the micro-waves are not affected by static. I have listened to them in a thunderstorm, but the static did not bother reception. Curious as it may seem, day and night do not influence them.

GUGLIELMO MARCONI.

On his first visit to this country since 1927 Senatore Marconi last week predicted remarkable developments in the communication field following present activities.

▼

Century of Progress End Scheduled This Month

The end of October will be the end of the Century of Progress Exposition in Chicago. Officially the fair closes at midnight October 31 and demolition will start immediately, according to well-scheduled plans. Eighteen months has been allowed for completion of the work of destruction.

Manufacturers are expected to withdraw their exhibits as soon as possible after the closing, leaving the buildings themselves for the wreckers. Removal of the buildings is entirely up to the South Parks Commission, as the contract between that organization and the sponsors of the fair provides that any structure which the South Parks Commission wishes to keep will be left where it is by the World's Fair without charge.

▼

Power Commission Wants To Control Own Funds

In an appeal filed recently with the Budget Bureau in Washington, the Federal Power Commission has requested that it be allowed to spend its own income. The commission, now engaged in a study of the costs of distributing power and co-operating with the Tennessee Valley Authority in developing administration water power policies, is one of the few government units earning more than it spends. In sending to the Budget Bureau its appropriation estimates for the coming fiscal year, the commission reminded Lewis Douglas, director, of its profitable operations. Income for the year ending July 1 aggregated $584,471 against expenditures totaling $281,429.

Under the water power law, a fee is charged against licenses chartered by the commission to pay the administrative costs, but the commission cannot spend these receipts. Its funds are appropriated independently of its income.

▼

Neon Sign Law Opposed

Widespread opposition to Chapter 285 of the laws of 1933 as enacted by the New Jersey Legislature is developing in that state. This chapter calls for the use of a "deviator" on gaseous tube signs and opposition centers around several elements. One is that the permissive equipment is alleged to be

manufactured by one maker only who holds a monopoly. Another is that the device is said to produce radio interference, and yet a third complaint centers around the supposed lack of necessity for the protection specified. Sign makers, utility men, broadcasting companies, glass tube makers, radio dealers and chambers of commerce are reported to have been represented in the establishment of a formal protest organization.

▼

Test of Public Ownership Plans Sought by T. V. A. Chairman

FORMATION of a chain of publicly-owned power plants was advocated by Arthur E. Morgan, chairman of the board of directors of the Tennessee Valley Authority at a meeting of the Public Ownership League of America held last week in Chicago. Chairman Morgan stated the board of the T. V. A. to be now engaged in preventing the proposed construction of power projects both near the mouth of the Tennessee River and near its source because it believes neither of these plants could be operated efficiently as single units. He declared that "if the Government, however, could own these plants and could establish an interlocking transmission system between them their combined power could be evened into constant flow not subject to seasonal rains which would eliminate waste and give order and system to the entire project."

He warned that the political patronage system must not go along with public ownership and declared that "the very life of the American nation is threatened by the custom of political patronage. "The more widely public activities are extended and the more government has to do with the management of our lives, the more sinister is this evil force." Predicting that the question of public or private ownership will not be settled by theory or propaganda, but by actual results of operation, he continued: "For the moment public ownership on a large scale seems about to have its chance. Whether that chance will be so used to usher in a new day in our economic life or whether it will result in a morass of incompetence, and so bring disgust and revulsion, remains to be seen. There is no assurance from on high that public ownership will bring honest and economical administration. I meet enthusiastic public ownership advocates who thrill with the conviction that the achievement of public ownership will perforce reduce public incompetence and corruption. They should take a lesson from prohibition."

Norris Dam plans revised

At a meeting of the three directors of the Tennessee Valley Authority at Knoxville with John L. Savage of the United States Reclamation Bureau, who designed the Boulder and Madden Dams, decision was reached to build the Norris Dam approximately 14 feet lower than originally planned. The consultation was called to pass on the height of the dam and its chief characteristics, in addition to reviewing the work on the plans to date. The height adopted for the dam will make possible the full use of the stream flow for power, according to a statement made by Chairman Morgan, except during exceptionally wet years, and it will also provide for flood control and navigation. Original War Department plans called for a dam rising 250 feet from bed rock, 185 feet wide at the base and an overall crest length of 2009 feet.

A memorandum issued recently by the Tennessee Valley Authority in relation to the Chickamauga dam originally included in the government engineers' survey made it evident that effort at navigation and flood control in the valley will be practically negligible. "The committee proposes," the memorandum reads, "that Hamilton County secure funds on its own credit for the construction of Chickamauga dam and that Hamilton County contract with the Tennessee Valley Authority for the complete control and operation of the dam by the authority. The construction will make provision for the future installation of power facilities."

Lilienthal on T.V.A. plans

"The starting point in any discussion of the power policy and program of the authority," stated David Lilienthal in Chattanooga, "must be this: That the distribution of electricity is not like the usual private business, but, in the language of the ancient common law, is a business 'affected with a public interest.' By its very nature, the business of generation and distribution of power is a public business, because in our present day community life we are all dependent upon that service. . . This power program is a constructive

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200,000 Attend National Electrical Show

Acme

Greeted on the last day with a crowd 75 per cent larger than on any other of its ten-day run, the National Electrical Exposition in Madison Square Garden, New York, closed after being visited by more than 200,000 people. Manufacturers estimated that over $1,500,000 business was actually done at this exhibition of radios and appliances for household use.

measure. Congress has not declared a national policy against the private ownership and operation of public utilities. It has merely provided for an additional measure of public protection against unreasonable or arbitrary conduct of a business which, by its very nature, is a matter of fundamental public concern. What the authority is trying to do in its power program is to set up an area for power operations which will be on a comparable basis with typical private operations. To set up such a yard stick the authority obviously must undertake to serve an area which is large enough and sufficiently concentrated, with enough population density and with a sufficiently diversified industrial, commercial and residential load to provide a fair test. . . . It will, therefore, be necessary to include several cities of fair size in the area. The people of Knoxville and Birmingham are soon to vote on the acquisition of their distributing systems. . . ."

"There has been a good deal of discussion of the adverse effect which the authority's program may have on privately-owned utilities. In working out its program and its policy to conform to the policies laid down by Congress, the authority is attempting to weigh with fairness the paramount public interest and the interest of the investors and managers of privately-owned utilities. Of course, there will be a period of adjustment, which will call for business statesmanship and due consideration to all interests affected.

"But there is one aspect of this program as it pertains to the private utility which seems to me has not been sufficiently stressed. If the resources of this Valley are developed and stimulated through this program which Congress has set up, then every one in the Valley will benefit from it, and among the beneficiaries will, of course, be those corporations engaged in the sale of electric power for the demand for power obviously, will greatly increase with an increase in industrial activity and an increase in the economic well-being of the people of the Valley."

P.W.A. active elsewhere

Returning from a two weeks, 1,200 mile inspection trip of the St. Lawrence waterway, Secretary of War Dern has stated: "I have been authorized by the President to state that he is solidly behind the St. Lawrence seaway project and is hopeful for early action. The task of our department is to investigate the St. Lawrence River for power and navigation. I have followed the project through the lakes from Duluth-Superior and down the St. Lawrence as far as Massena."

An allotment of $20,000,000 from the Public Works Administration for construction of a dam and six hydro-electric generating units at Bonneville, Ore., on the Columbia River has been made. The total cost of the development is estimated at $31,000,000. Allotment of $63,000,000, for the Grand Coulee development, also on the Columbia was made previously.

Expansion of Credit Pushed

Credit inflation on a vast scale constitutes the next step in the recovery program. In but little more than a week it has been placed in the center of the NRA stage. Public works construction is being rushed, government loans will aid purchasers of equipment, government buying of relief supplies will be pushed. Currency inflation will, it appears, be left as the last trick in the bag and therefore indefinitely postponed. Early moves to stabilize the currency are freely predicted in financial circles where, however, direct information appears to be as scarce as elsewhere. Labor opposition to inflation voiced.

Figures of the week show mixed trends; those reflecting trade volumes and actively rallying somewhat; those indicating price relationships falling off. Thus, electrical energy output regained the previous loss and stepped above the 1931 curve which it has approximated since July, carloadings showed an infinitesimal gain over the previous week, retail sales rose sharply for the month in department and chain stores, electrical appliance sales in New York metropolitan district notably strong. Steel and bituminous coal responding to strike conditions both wavering, automobile output off perhaps to clear dealer stocks, lumber production off. Commodity and security prices weak in listless trading broken by sharp, mid-week rally. General indexes rallied somewhat from declining trend.

Influences now active include; resumption of the Wall Street investigation by the Senate banking committee, permanent organization of NRA nears actuality, President Roosevelt addressed veterans on theme of unity, and, action to counteract the spreading strike-menace grows likely.

Insull Trial This Week; Merger Move Inactive

Trial of the extradition case against Samuel Insull wanted by the United States Government to answer a charge of violation of the bankruptcy laws, was set last week to begin in Athens on October 7. The indictment filed with Greek authorities referred not only to the former utilities operator but also to nine other persons, including Samuel Insull, Jr., and Martin Insull. The indictment which was served by the Secretary of the Department of Justice, consists of five distinct parts.

The first part charges the defendants with the transfer, in contemplation of bankruptcy, unlawfully and fraudulently of $558,120 worth of property belonging to the Corporation Securities Company. The second charges them with the illicit transfer on December 13, 1931, of 500 Commonwealth Edison shares worth $91,700. The third charges the illicit transfer on December 15, 1931, of 60,000 Middle West Utilities Company shares worth $390,000 belonging to the Corporation Securities Company. The fourth, charges the transfer on December 2, 1931, of $1,000,000 from the credits and funds belonging to the Corporation Securities Company. The fifth charges the illicit transfer of $291,000 on January 20, 1930, from the funds belonging to the securities company. The indictment was based, not on a violation of the Illinois State Bankruptcy Act, but on the Interstate Bankruptcy Act.

No official announcement has been made concerning reports of an exchange stock offering to shareholders of Public Service Company of Northern Illinois (ELECTRICAL WORLD, Sept. 30, page 421). Following the rumors last week of a unity program for the Chicago utilities, the stocks of the company veered sharply downward; rates and taxes were an influence.

Following a suit filed by Samuel Ettelson in behalf of Gus Lowry of Sullivan, Ind., holder of $6,000 debentures of the bankrupt Insull Utility Investments, Inc., a temporary restraining order preventing removal by Samuel Insull or any representative of any part of a $1,000,000 secret fund which, it is said, he created for himself before his flight to Greece was issued by Judge John P. Barnes in Federal Court early this week.

Mr. Ettelson told the court that Mr. Insull maintains a secret bank account of more than $1,000,000 in securities and gold bullion under the account name of Constantine S. Eftax with the purpose of utilizing the fund in defending himself against the pending extradition proceedings. The suit avers that there is no such person as Constantine S. Eftax. Formal denial that Insull maintains a secret account in the Harris Trust and Savings Bank was filed in court by the law firm of Chapman & Cutter, representing the bank.

Boulder Dam Contracts Awarded

Orders have been placed by the Bureau of Reclamation of the Department of the Interior for the initial installation of generators for the Boulder Dam power plant with the General Electric Company, Westinghouse Electric & Manufacturing Company and the Allis-Chalmers Manufacturing Company on the terms announced when the bids were submitted to the Bureau (ELECTRICAL WORLD, September 2, page 297).

Coming Meetings

National Association of Railroad and Utilities Commissioners — Cincinnati, Ohio, October 10-13. James B. Walker, 270 Madison Ave., New York.

Association of Iron and Steel Electrical Engineers — Pittsburgh, Pa., October 17-19. John F. Kelly, Empire Building, Pittsburgh.

American Society of Mechanical Engineers—New York, N. Y., December 4-9. C. W. Rice, 29 West 39th St., New York.

American Institute of Electrical Engineers—New York, N. Y., January 23-26. H. H. Henline, 29 West 39th St., New York.

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Regulatory Simplicity Urged by Commission

Public service commissioners were criticised by H. Lester Hooker, president of the National Association of Railroad and Utilities Commissioners and chairman of the Virginia State Corporation Commission in speaking before the closing session of the American Gas Association convention in Chicago last week for not interpreting their findings to the public in language that the average business man can understand. He also made a plea for speedier determinations of rate cases.

Making it clear that he spoke as an individual commissioner and not as spokesman for his associates in the national organiation, Mr. Hooker said:

"The most outspoken critics of prevailing rates may be determined to wreck the utilities, perhaps. The general public, however, I sincerely believe, is willing to 'live and let live'; it is willing to pay rates for the utility services it consumes sufficient under normal conditions to cover the operating expenses, taxes, and a fair return on the fair value of the property of the public service corporation rendering the service. Is this not the same principle which permeates all judicial rulings as to the determination of fair rates?"

Public does not understand

In many cases the present process, Mr. Hooker said, does not answer the question in the public mind in the matter of variations in rates between nearby places. Neither does it answer the question as to whether or not the physical plant installed is intelligently planned or is the most efficient plant available, nor does it answer the public question as to whether or not the company is efficiently managed.

The public, he said, apparently does not intend to pay a rate based on plant valuations where the plant is not modern or is not efficient. Neither, he said, does the public intend to pay a rate that is higher than neighboring rates because of inefficient or excessively costly management.

Mr. Hooker said rate investigations must deal not only with the actual determination of fair rates, but, in addition, it must be so designed as to interpret to the public why the rates fixed are fair and how their fairness has been determined.

Regulation of the future

"It may be too radical a statement to say that on this type of investigation rests the future of privately owned public utilities," he said, "and yet strange economic changes are taking place in this country almost overnight. It may be, if the commissions in the various states do not interpret their findings to the general public in an adequate way, that, in many localities, experiments will be started in publicly owned plants that will destroy literally millions of dollars of useful property that does now serve the public as economically as will the publicly owned plants. This type of competition, under a system of proper regulation, destroys useful property and is pure economic waste.

Recommending that rate changes for public utilities should be quick to respond to the public need, Mr. Hooker said, "many of us are familiar with rate case hearings that have taken months and sometimes a year or more to be presented to the commission. This, obviously, does not meet the present ideas of the public. One of the new fundamentals, then, of rate control is to develop a method that will get speedy action on questions that heretofore have taken a long time."

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Northwest Association Committees

Engineering and operation studies under four committees are to be undertaken this year by the engineering and operation section of the Northwest Electric Light and Power Association. Committees as selected by the executive committee will be: Production and generation, J. E. Yates, Pacific Power & Light Company, chairman; transmission and distribution, T. A. Purton, Idaho Power Company, chairman; utilization, Paul P. Ashworth, Utah Power & Light Company, chairman; and general, J. B. Fisken, Washington Water Power Company, chairman. The other two sections, business development, corresponding to the old commercial section, and accounting and business practice, corresponding to the former accounting section, are laying plans for their activities for the year, but have not yet announced organization details.

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Ironer Sales Up Too

Refrigerator and washing machine manufacturers are not the only ones who may point with pride to sales increases and recovery acceleration. According to President Walter J. Conlon of the Conlon Corporation, maker of household ironing machines, "in May our business was normal in the meaning of the word then. June was 52 per cent larger in units. July was twice June and, August was more than double July."

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Kentucky Utility Indicted

Twenty-four indictments charging failure to pay interest on consumer deposits have been returned against the Kentucky Power & Light Company, Maysville, by the Mason County grand jury. The indictments are based on a law enacted by the 1932 legislature requiring utilities to pay 6 per cent interest on deposits. The deposits are required of all new customers. The requirements in Maysville are $5 for electricity and $5 for gas. The grand jury reported that to the best of its knowledge the company had paid no interest whatsoever on deposits.

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Associated Deposits Increase

Deposits of debentures under the Associated Gas & Electric Company plan of rearrangement of debt capitalization have shown a marked increase in the past two weeks, according to company announcements. The number of holders who have deposited debentures now totals approximately 30,000.

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American & Foreign Power Benefits by Dollar's Drop

Recent derangement of foreign exchange has been advantageous for American & Foreign Power Corporation, although the company was handicapped previously (ELECTRICAL WORLD July 16, 1932, page 68) by the limitations set up by the governments of many foreign countries in which it operates. According to the annual report of the company for 1932, issued last week, the application to foreign currency working capital accounts at Dec. 31, 1932, of exchange rates prevailing on July 31 of this year would have increased the year-end surplus of the corporation by approximately $3,188,000. As of December 31, the net amount of cash and receivable items, less current liabilities, in countries having restrictions on transfers of funds was $4,881,380. For the year the net equity of the parent company in incomes of subsidiaries was $15,139,161, of which approximately $9,729,886, or 64 per cent, was subject to official regulations restricting conversion into United States currency.

Total operating revenues of the corporation and its subsidiaries for the year ended December 31 were $53,137,081.

against $65,426,170 in the preceding year. After deducting interest, taxes, expenses and other charges of the parent company, the balance of income available for American & Foreign Power stocks was $7,079,053, before deducting exchange adjustments, against $16,246,725 in the preceding year. No provision has been made for accumulated dividends on preferred stocks of the parent company.

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Dividend Cuts Continue California Edison Pays

Dividends are being reduced or omitted by many operating and holding companies some with long, unbroken records for sustained disbursements to stockholders. The reason lies in the well-known problems of increased costs, and reduced revenues in which taxation plays a most important role.

Battling against the tide, Southern California Edison Company has decided to maintain the dividend on its common stock although the current payment has not been fully earned. "We are endeavoring," Harry J. Bauer, president of the company states in a letter to stockholders, "to do our part in the national recovery program and any reduction in our common dividend at this time would tend to decrease purchasing power and thus to injure business in this community. . . . We believe that the payment would be justified alone as an expression of the confidence which we feel in the business outlook. . . . This company has been paying a dividend at the annual rate of $2 a share on its common stock. . . . During the intervening years of plenty, this dividend was not increased, but surplus earnings from the operations of the company were returned to the consumers in the form of rate reductions, of which there have been more than twenty since 1921, aggregating $88,000,000, or were passed to the surplus account as a reserve for periods like the present. . . . Because of the unprecedented increase of taxes, of an increase in fuel bills owing to subnormal rainfall, a general decline in the volume of business and rate reductions, the earnings during the year 1933 on the common stock will fall short of $2 a share, notwithstanding increased efficiency and economies. However, for the first time in the last three years our load recently has shown an increase over the same period of the preceding year. This company's cash position is sound. It has no maturities for many years. The difference between the amount actually earned this year and the $2 rate can be made up from the surplus accumulated for that purpose without injury to any interest involved. . . ."

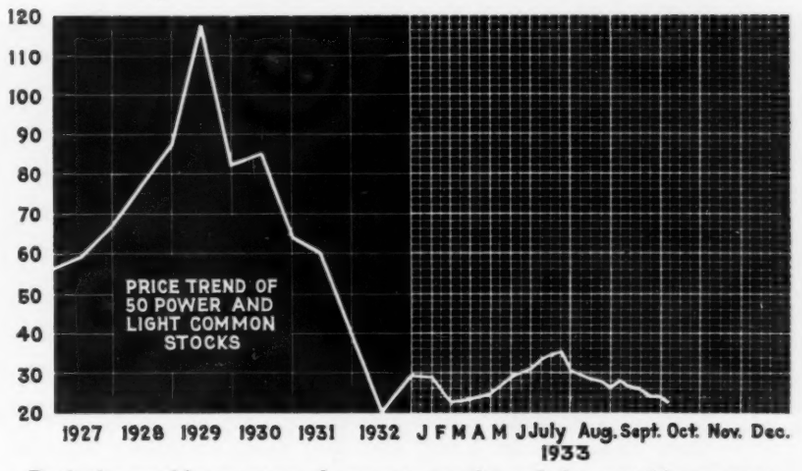
Among the companies which have recently omitted dividends is the Mohawk Hudson Power Corporation, an important unit in the Niagara Hudson Power System. P. A. Schoellkopf, president, notified holders of the company's second preferred stock that because of decreased revenues from operating subsidiaries, increased taxes and higher operating expenses as a result of the NRA program, the dividend due October 2 has not been declared.

Central Power Company has deferred payment due October 16 on its 6 and 7 per cent cumulative preferred stocks.

Two utility companies halved dividends last week. The California-Oregon Power Company, a subsidiary of the Standard Gas & Electric Company, declared a quarterly dividend of 87½ cents a share on the 7 per cent preferred stock, 75 cents on the 6 per cent preferred stock and 75 cents on the 6 per cent cumulative preferred, series of 1927. The new rates are one-half the regular rates previously paid. The Public Service Company of Indiana, a former member of the Insull group, declared a quarterly dividend of 75 cents a share on the $6 cumulative prior preferred and 87½ cents on the $7 cumulative prior preferred shares. Three months ago the regular rates, $1.50 and $1.75, respectively, were paid.

Northern Indiana Public Service Company has declared a dividend of one-half of its quarterly dividend on the cumulative preferred stocks, payable October 14 to stockholders of record Sept. 30, 1933. The dividend was 87½ cents per share on 7 per cent preferred, 75 cents per share on 6 per cent preferred and 68.75 cents on 5½ per cent preferred.

Utility Securities Continue Decline



Both the weekly average of common stocks and the monthly average of bonds show declines. Stocks which last week stood at 23.9 are now 23.3. Bond prices have fallen, bringing the average from 91.0 at the beginning of last month to 88.6.

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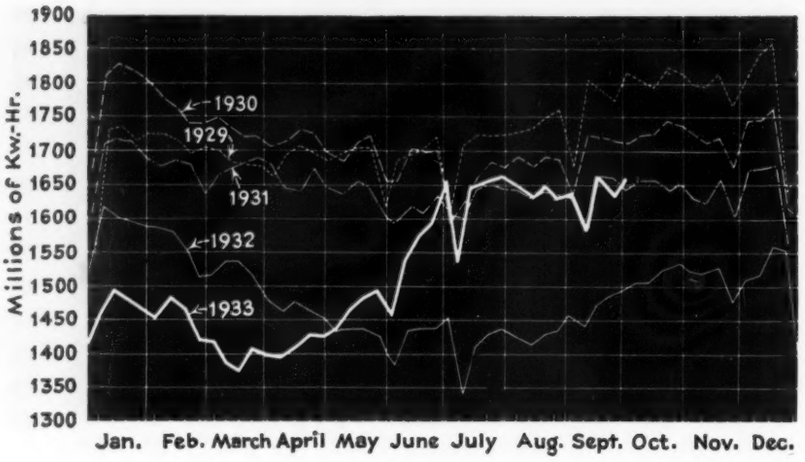
Week's Output Passes 1931



Some improvement, possibly attributable to increased lighting, appears in the central station output of 1,652,811,000 kw.-hr. reported for the week of September 30 by the Edison Electric Institute. Production was 14,000,000 kw.-hr. greater than in the preceding week; the gain over 1932 rose slightly to 10.2 per cent. The recent moderate deficiency compared with 1931 was replaced by a slight excess; virtual equality with that year has continued for 14 weeks.

Regional gains were generally maintained. High percentages over last year continue in the Mountain states. The Southern increase is the largest since August 19; the diminished gain in the Central area is measured against last year's rising trend.

Weekly Output, Millions of Kw.-Hr.

1933		1932		1931	
Sept. 30..	1,653	Oct. 1..	1,499	Oct. 3..	1,646
Sept. 23..	1,639	Sept. 24..	1,491	Sept. 26..	1,660
Sept. 16..	1,663	Sept. 17..	1,476	Sept. 19..	1,663
Sept. 9..	1,583	Sept. 10..	1,424	Sept. 12..	1,582
Sept. 2..	1,637	Sept. 3..	1,465	Sept. 5..	1,636

Per Cent Change from Previous Year

Region	Week ended Sept. 30	Sept. 23	Sept. 16
New England	+ 8.0	+ 8.6	+ 9.5
Middle Atlantic	+ 5.7	+ 4.7	+ 9.3
Central industrial	+12.7	+13.5	+17.9
West Central	+ 3.0	+ 3.5	+ 6.9
Southern States	+15.8	+11.7	+10.7
Rocky Mountain	+29.4	+28.0	+27.6
Pacific Coast	+ 1.9	+ 1.3	+ 1.2
United States	+10.2	+ 9.9	+12.7

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British Survey Shows Homes 43.6 Per Cent Wired

Recent compilations indicate that four out of nine homes in Great Britain are today wired for electric service. In 1932 the proportion was roughly four out of eleven. An increase of 5 per cent in one year is indicated.

There are now 11,197,620 homes in Great Britain, according to an Electrical Trading Survey, of which 3,835,387 receive a.c. service, 1,046,784 are served with d.c. and 6,315,449 are unwired. Thus 43.6 per cent are wired—34.3 per cent for a.c., 9.3 per cent for d.c.—and 56.4 per cent unwired.

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Spanish Power Station

In the 18,750 kva. Jandula power station on the upper Gaudalquivir River in Spain the power house has been located within the dam structure. The latter is of the solid gravity type 306 ft. high and 720 ft. long. Two 7,500 kva. and one 3,750 kva. generators are installed. Each has a pneumatic braking device capable of bringing the machines to a standstill from full speed within a few minutes.

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August Output 13% Up Geological Survey Reports

Public utility plants generated 2.4 per cent more energy in August than in July, and 13 per cent more than in August of last year. The year-to-year gain, which had risen to 14 per cent in July, was thus approximately maintained. Total output, as announced by the U.S. Geological Survey, was 7,646,000,000 kw.-hr., of which 38 per cent came from water power. Output from the latter source increased somewhat, owing to heavy rainfall.

In three of the nine geographical regions the rate of increase over August, 1932, exceeded and in a fourth one approached 20 per cent. The reported percentages were: New England 23, Middle Atlantic 9, East North Central 19, West North Central 2, South Atlantic 25, East South Central 11, West South Central 4, Mountain 21, Pacific 7.

Plants for electric traction and others producing energy for public use, as well as electric light and power plants, are included in this summary.

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Census Bureau Reports on Light and Power Survey

Publication has been begun of preliminary reports by the Bureau of the Census on results of the recent quinquennial census of electric light and power companies. Thus far statistics have been released for only two states, Nevada and Montana. Comparisons with the figures for 1927 show an increase in the number of customers and in the use of internal combustion engines, but a greatly decreased energy output. In Montana the generator rating increased 18.5 per cent.

	Nevada		Montana	
	1932	1927	1932	1927
Number of reporting establishments	18	18	27	27
Commercial	14	14	23	25
Municipal	4	4	4	2
Number reporting distribution only	10	9	6	8
Number of customers	20,369	15,583	86,267	80,919
Prime movers, total hp	19,691	18,976	451,820	378,242
Steam turbines, hp	3,000	201	10,260	11,457
Steam engines, hp	....	415	13,126	2,535
Int.-comb. engines, hp	3,076	2,395	4,491	747
Hydroturbines, hp	13,615	15,965	423,943	363,503
Generator capacity kw	13,078	13,090	318,313	268,509
Output, thous. kw.-hr	37,634	57,137	635,520	1,398,749

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40,000 hp. Oklahoma Project?

Tentative federal approval of the Fairfax-Kaw City power project as part of the flood control program for Oklahoma, has been given by government engineers, according to advice from Washington. The proposed fall of 122 feet would operate a power plant which would produce 40,000 hp.

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Kansas City May Go to Oil

Kansas City Power & Light Company, equipped for ready conversion of its power plants from coal to gas or oil operation, is reported to be seriously considering such a changeover. Unrest in the Kansas and Missouri coal fields is thought to imperil the coal supply.

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Oil Burner Orders Increase 41 per Cent

Orders for oil burners were 41 per cent more numerous in August of this year than last and closely approached 1931 figures, according to government compilations. The year's total thus

far shows the effect of weakness in earlier months, however. The number of units with mechanical draft, sold for domestic use, the group of chief interest to the electrical industry, rose 30 per cent over 1932, while the number for industrial use was multiplied four-fold. The following figures are taken from a report by the Bureau of the Census based on returns from 103 manufacturers:

New orders	1933	1932	1931
Total, August	10,314	7,319	10,621
Total, July	6,212	....	.....
Total, 8 months	34,065	36,584	47,714
Mechanical draft, Aug.			
Domestic	8,028	6,197	8,426
Industrial	1,510	367	471

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N.E.M.A. Sees Labor Threat to Recovery

FULL TEXT of the labor resolution adopted by the National Electrical Manufacturers' Association at its Cleveland convention (ELECTRICAL WORLD, September 30, page 419) was this week released to the press. By authority of the Board of Governors, N.E.M.A. goes on record and asserts a positive stand for active resistance to any further intrusion into employer-employee relationships "on the part of anyone" beyond the spirit and letter of the code under which the association and its members now function. Widespread sowing of dissension and discord as well as strike threats and other intimidating actions by labor against employing groups and plants of N.E.M.A. are the reported promptings of this action.

The full text of the resolution follows:

WHEREAS, immediately after the passage of the National Industrial Recovery Act, the National Electrical Manufacturers Association presented a code of fair competition for the electrical manufacturing industry which was approved by the president, August 4, 1933, and

WHEREAS, the members of National Electrical Manufacturers Association have made every endeavor to comply with the provisions of said code and particularly with the hours of labor and wage provisions thereof, including adjustments in the higher wage brackets, and

WHEREAS, it is the expressed desire of the National Recovery Administration that industry be self-governing and that there be Federal control only to such extent as will assure that adopted policies and practices conform to the spirit of the National Industrial Recovery Act and will promote the general national good and that no one shall suffer from exploitation, and

WHEREAS, the National Industrial Recovery Act provides in Section 7 (a):

> "(1) That employees shall have the right to organize and bargain collectively through representatives of their own choosing, and shall be free from the interference, restraint, or coercion of employers of labor, or their agents, in the designation of such representatives or in self-organization or in other concerted activities for the purpose of collective bargaining or other mutual aid or protection; (2) that no employee and no one seeking employment shall be required as a condition of employment to join any company union or to refrain from joining, organizing, or assisting a labor organization of his own choosing; and (3) that employers shall comply with the maximum hours of labor, minimum rates of pay, and other conditions of employment, approved or prescribed by the President,"

and

WHEREAS, the requirements of the said Section 7 (a) were in part interpreted jointly by the Administrator and the General Counsel of National Recovery Administration on August 24, 1933 as follows:

> "The law requires in codes and agreements that 'employees shall have the right to organize and bargain collectively through representatives of their own choosing.'
>
> "This can mean only one thing, which is that employees may choose any one they desire to represent them, or they can choose to represent themselves. Employers, likewise, can make collective bargains with organized employees or individual agreements with those who choose to act individually; provided, of course, that no such collective or individual agreement is in violation of any State or Federal law. But neither employers or employees are required, by law, to agree to any particular contract, whether proposed as an individual or collective agreement,"

and

WHEREAS, various members of National Electrical Manufacturers Association have been confronted with demands that certain labor unions, as such, be recognized as sole representatives of employees for collective bargaining purposes with consequent strikes or threat of strikes for failure to agree to such demands and intimidation of, violence and threats of violence to, employees not members of the unions involved, and

WHEREAS, assent to such demands and recognition of a labor union as the sole representative of all employees would be a violation of the code for the electrical manufacturing industry and would subject an assenting employer to prosecution and would prevent employees not members of such union enjoying the rights granted to them by the act;

NOW, THEREFORE, BE IT RESOLVED by the members of National Electrical Manufacturers Association in annual meeting assembled on September 26, 1933, that they will continue to comply in all respects with the provisions of the code for the electrical manufacturing industry, approved by the president of the United States on August 4, 1933, and particularly with the requirements of Section 7 (a) of the National Industrial Recovery Act, as set forth in said code, but that they will resist any attempts on the part of any one to interfere with the rights of employers or employees thereunder and will support in every proper and legal manner and by all proper and legal means any and all members of the association who may be subjected to demands in excess of the requirements of said code.

Major New Construction This Week

Radford, Va., asks bids until October 24 for complete city-owned hydroelectric power plant on Little River. Fund of $129,000 available.

Motors, refrigerating equipment, conveyors, etc., will be installed in new market building of Swift & Company, New York, N. Y. Cost about $200,000.

Nebraska Light & Power Company, Lincoln, Neb., plans new transmission lines in parts of Mills and Cass Counties. Application made for permission.

California Brewing Association, Vernon, Calif., recently organized subsidiary of Cereal Products Refining Corporation, San Francisco, plans new four-unit plant with power station. A $750,000 project.

Danville, Va. is arranging fund of $2,500,000 for city-owned hydroelectric generating plant with transmission system. Early call for bids planned.

Bureau of Reclamation, Denver, Colo., plans early call for bids for hydroelectric plant on Columbia River, near Bonneville, Ore., also steel tower transmission line. Initial appropriation of $20,000,000 approved.

Heavy duty motors, regulators, etc., required by J. J. & M. Taxman Refining Company, Wichita Falls, Tex. Cost about $200,000.

Hammond (La.) Brewing Corporation, recently organized, will build plant and power station at cost of $250,000.

Ironwood, Mich., has authorized plans for city-owned electric light and power plant. Financing for $900,000 being arranged.

Duluth, Minn. asks bids until October 13 for nine electric-operated pumping units for sewage pumping plants.

Powerhouse, motors, regulators, pumps, conveyors, etc., will be installed by Continental Malt Company. Cost over $160,000.

Idaho Power Company plans 30-mile, 66kv. line from Jarbridge to Mountain City, Nev. A $100,000 project.

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New York Metal Prices

	Sept. 26, 1933 Cents per Pound	Oct. 3, 1933 Cents per Pound
Copper, electrolytic	9.00	9.00
Lead, Am. S. & R. price	4.50	4.50
Antimony	7.00	7.00
Nickel ingot	35.00	35.00
Zinc, spot	5.12	5.12
Tin, Straits	47.25	48.80
Aluminum, 99 per cent	23.30	23.30

As to Rates——

● Detroit Edison Company has tendered the second of a promised series of voluntary rate readjustments in a communication addressed to the Public Utilities Commission requesting approval of rate changes expected to save $200,000 annually for 600 apartment house, office building and store customers. This projected readjustment follows the rate reduction offered September 8, which, it was estimated, would result in saving of $800,000 annually to approximately 30,000 customers (ELECTRICAL WORLD, August 26, page 264). In announcing its intention to make the new $200,000 cut, subject to approval by the commission, the company declared that "this is the second step in our plan to simplify our rate schedule and encourage a freer use of our plant and facilities."

● Columbus (Ohio) Railway, Light & Power Company rate schedules have been slashed $1,262,558 a year by the ordinance passed last week by City Council. The new reduced schedules were drawn up for a five-year period beginning November 15, eight days after the election. "In nearly all cases we have accepted the company's figures so I can't see how they can hope to combat the reductions before the commission or in the courts," said J. Paul Blundon, who conducted the investigation and made recommendations relative to the reduced rate schedules (ELECTRICAL WORLD, September 30, page 426). In the residence and commercial classifications the savings were effected by cutting the per kilowatt-hour rates; in the industrial class it was provided by increasing the discount for prompt payment of bills from 5 to 15 per cent. The residence schedule provides a savings of $807,848 with the maximum charge cut from 6 to 4 cents per kilowatt. This means a 30 per cent cut in the home consumer's monthly bill. The savings provided for commercial customers totaled $289,211.

● Northwestern Electric Company's case before the Oregon Public Utilities Commissioner in the matter of valuation rates and services was resumed recently after the company filed its inventory and appraisal early in July. A number of engineering examiners and real estate appraisers appeared with testimony concerning various individual pieces of property. Toward the end it was disclosed that the commission's valuation would probably come to some $5,000,000 less than the company's appraisal. During the course of the hearing several pieces of property were declared obsolete or not useful in the public service and it was indicated that the commissioner's final order would exclude such properties from the rate base.

● Ludlow Electric Light Company will not be compelled to reduce its rates according to a decision given last week by the Massachusetts Department of Public Utilities, dismissing petition for a rate reduction. In its order the commission says: "We believe that the first six months' operations of 1933 may not be a proper basis for estimating the earnings of this company for this year, for the reason that during this time the mills of the Ludlow Manufacturing Company, which is substantially the only industry in the town, were operating at a very small capacity and are now operating at a much greater capacity. However, taking all the evidence in the case into consideration, we do not feel that we should order a reduction in the rates at this time."

● United Electric Light Company was represented before the Department of Public Utilities in connection with reduction in rates sought by the city of Springfield, Mass. (ELECTRICAL WORLD, August 5, page 168), when W. Rodman Peabody, testified that stockholders of the company received dividends equal to 5.1 per cent on the company's plant account and 7 per cent on assessed valuation. A return of 5.1 per cent, he thought, was not unreasonable for a public utility in these times. Referring to rate cuts made during the past decade, counsel said that in 1922 the rate per kilowatt-hour was 9½ cents. Reductions have brought the rate down to 5½ cents per kilowatt-hour for the top price and the average rate to 5 cents at the end of 1932. Saving to customers during this period was some $10,000,000. City Solicitor Ryan, appearing for the petitioners, asked the department to order a one-half cent per kilowatt-hour reduction in the company's present rates. In connection with this rate petition there has been filed with the Public Utilities Commission a petition from United Local 201 of the Brotherhood of Edison Employees of America (United Electric employees), stating that during the past four years they have been adversely affected by general economic conditions and industrial depression and that any order by the department which may endanger and imperil the economic condition of the employees, will be contrary to policy of the NRA, unless such order shall properly protect the employees from being adversely affected by any rate reductions which may be made by the Department.

● Public Service Company of Indiana, contending that the Public Service Commission cannot demand the company prove that their rates are not unjust, the burden of proof lying with those petitioning for reductions, has asked that the rate case against it be dismissed by the commission. Present rates, according to the company attorneys, are insufficient, confiscatory and unfair, the company now earning approximately 4.5 per cent on its investment and but entitled to an 8 per cent return. In reply to the demand of the company Chairman Perry McCart of the commission said that utility rates must be reduced to the level the service is worth —a price people can afford to pay, and overruled the company plea to checkmate the case.

● Nebraska Railway Commission has overruled a demand made by Commissioner Bollen that it require all power companies to file rate schedules and financial statements of operations with it at stated periods (ELECTRICAL WORLD, September 30, page 426). The commission majority holds that the Legislature has commanded it, with relation to electric companies, to go no further than supervise security issues. It holds that to accede to the demand would mean that: the commission is attempting to enlarge jurisdiction by indirection; it would be spending public funds in an analysis of data and reports without any purpose or objective; that it would be requiring an economic waste by companies without any objective and with no jurisdiction; that it might be indirectly endeavoring to impose similar requirements regarding municipal plants, and that the entire procedure would be absolutely useless and unnecessarily expensive and would accomplish nothing for any taxpayer.

New York hearing closes

● New York Public Service Commission completed last week the rehearing on its order directing temporary emergency rate reductions by the electric companies of the Consolidated Gas system. In the concluding testimony Robert B. Grove, vice-president of the New York Edison and of the United Electric Light & Power Company, said the seven electric affiliates of the Consolidated had placed 1,780 additional employees since August 12 under the NRA utility code. Chairman Maltbie noted a net drop of 930 in the number of employees between last January 1 and August 12, and reminded Mr. Grove that "showing gross additions of employees without showing releases, retirements and resignations isn't any more proof than showing gross additional fixed capital without giving retirements." Mr. Grove testified later that 137 employees had left since August 12, but that their places would be filled in addition to 2,100 to be employed under the code. Of 1,225 hired between August 12 and September 23, he said, 736 were new employees and 489 were former employees. At the hearing the chairman announced that the rehearing order had been amended to permit the inclusion of evidence of additional costs to the companies incurred through the increase in city water rates and the proposed excise tax on gross incomes. These data were then introduced.

● Central Hudson Gas & Electric Cor-

poration reduction in gas and electric rates totaling $133,000 has been accepted by the Public Service Commission. These new rates are to be filed as permanent and not temporary rates and the company has agreed to file them within the near future so that they may become effective as soon as possible.

● Public Service Electric & Gas Company will have to state how much it spent in 1932 for advertising and how much, if any, for political campaign contributions, but will not need to give specific details of such expenses, the public utility commission ruled last week in the hearing on the petition to compel a reduction of electric rates by the company. The hearing will continue October 9. John A. Matthews, of counsel for the petitioners, asked for the names of all persons holding 1,000 shares or more of common stock in Public Service Corporation, or 25 shares of preferred of Public Service Electric & Gas. The commission ruled the company need not answer this question, except where the stock was held by members, employees, or attachés of the commission. The company also was ordered to give a list of officers and their salaries, and group listings of other employees getting $5,000 or more annually, without naming the latter. The company will not have to produce records on assessed valuation of its electrical properties, under the ruling. Dr. John L. Bauer, expert on public utility rates, testified before the commission that Public Service Electric & Gas Company could reduce consumers' bills 27.14 per cent and still make 6 per cent profit. He stated that the company is now making $17,788,000 a year in excess of 6 per cent on its investments.

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Municipal Items

ANDALUSIA, ALA.—At a special election, this city of more than 5,000, has voted 414 to 220 in favor of a proposed municipal electric distribution system.

BIRMINGHAM, ALA.—With the organization of the Citizens Protective Committee the second step has been taken in opposing municipal ownership of the local utilities. There is a possibility of this committee's joining with the Association Opposed to Municipal Ownership formed recently (ELECTRICAL WORLD, September 30, page 427).

VILLISCA, IOWA.—Application will be made for a grant and loan of $150,000 under the National Industrial Recovery Act to finance a municipal light and power plant and distribution system.

MOBERLY, MO.—Application has been filed with the Missouri State Advisory Board of the Public Works Administration, St. Louis, for a $700,000 grant and loan to finance the construction of a municipal light and power plant.

TIPTON, IND. — City Council at its last meeting adopted a plan for the installation of new steam turbines at the municipal electric plant. The installation will consist of two turbines of 1,000 kw. capacity each and will cost approximately $169,000, which allows for improvement of the present building and 5 per cent for new boilers.

Of $70,000,000 available for the State of Indiana from the Federal Emergency Administration for public improvements, municipalities have asked only $7,500,000. Approximately $5,000,000 of that amount has been approved by the Indiana committee for fourteen projects. The Indiana committee, among other things, has authority to approve plans for the building of municipal light plants.

KENNETT, MO.—Mayor Paul C. Jones has applied to the Missouri State Advisory Board, Federal Emergency Administration of Public Works for a loan of $103,500 and a grant of $36,500 under the National Industrial Recovery Act to finance the construction of a municipal light and power plant. Bonds for this project have been voted.

SALEM, ORE.—Construction of a $12,000,000 munipically-owned power plant on the McKenzie River to supply power and lighting service for all Willamette Valley cities is proposed by the water board of the city of Eugene. The board will make application to the federal public works administration for funds for financing the project. Tentative plans call for construction of the proposed plant at the so-called Rennie dam site below Blue River. Purchase of the plant and distributing system of the Mountain States Power Company, which serves 32 cities in western Oregon, is also said to be under consideration in connection with the ambitious program of the city of Eugene.

BELLINGHAM, WASH.—Ignoring the advice of R. H. Thomson, consulting engineer of Seattle, commissioned to submit a report on a proposed municipal power plant, the city council has voted to proceed with its plan for a bond issue to finance such a project. Mr. Thompson opposed the plan on the ground that the cost would be too near the rates charged by the private companies.

TACOMA, WASH.—Combined hearing on several applications for franchises to construct power lines of the city of Tacoma light department on county roads to be held shortly is expected to develop interest, because the county board plans to incorporate a 7½ per cent gross earnings tax provision in the franchise. Tacoma would sell electric energy to suburban districts at regular city rates, but make a service charge for original connection of $10 instead of the $1 charge made within the city. The city will apply its customary rule of being willing to spend up to three times the annual revenue to be derived from a line in the capital outlay of line extensions. It is understood that this rule will allow extension of all the contemplated lines without additional charge to the rural residents.

BELOIT, WIS.—Holding that it is not necessary to obtain a certificate for "convenience and necessity" from the Wisconsin Public Service Commission in order to erect a municipal power plant, Circuit Judge George Grimm of Jefferson has stated erection and operation of a municipal power plant to furnish power for lighting streets and public buildings to be "a governmental function" not to be construed as the operation of a public utility. The judge overruled a demurrer to the Wisconsin Power & Light Company to the city's answer to injunctions sought by the utilities organization. The utilities will take an appeal to the Supreme Court of the state.

CINCINNATI, OHIO—Stockholders of the Cincinnati Gas & Electric Company are being urged to take immediate action to protect their property against a proposal to have the city of Cincinnati acquire the public utility properties operating there. A letter to them reports that a petition has been filed with the city asking to have submitted at the next municipal election a proposal to acquire all the gas and electric properties serving the city. The company is a subsidiary of the Columbia Gas & Electric Corporation. The proposal, according to the letter, would require the company to surrender its properties to the city upon payment of a sum to be determined by a jury of twelve to be "demanded by the city solicitors."

SIKESTON, MO.—In an opinion written by Commissioner George H. English, the State Public Service Commission has denied an application of the city to order the Missouri Utilities Company to abandon its plant. In the application filed with the commission November, 1932, the city asked that the company's certificate of public convenience and necessity be set aside and the company ordered to vacate the streets, avenues and public ways of the city. The Supreme Court, a short time before, held the city was estopped from ousting the utility because the company had been allowed to operate, pay taxes and make improvements to its plant after its franchise had expired. The Supreme Court said it was for the Public Service Commission to determine whether a need for the company's service still existed.

ORD, NEBR.—North Loup Hydro-Electric and Irrigation District has filed an application for a $2,900,000 allotment under the National Industrial Recovery Act to finance the construction of improvements to include a main canal about 4 miles long, from Taylor to Ord with reservoir and power unit near Sioux Creek. Dam near Ord to be 40 ft. high and 400 ft. long.

Thoughts of an Operating Executive

A frank discussion of utility problems.
Public relations, finance, rates, engineering and employees.
Suggestions for improvements.
A difficult time ahead.

By F. R. PHILLIPS,*
President Philadelphia Company

THE changes in our social, political and economic systems are fundamental and therefore present new problems of a major character which demand the most careful and serious consideration of our operating executives. What executive foresaw five years ago, when his whole time and effort was being expended in securing the necessary capacity at any cost to meet consumer demand, when the question of rates was little thought of, when wages and dividends were all but automatically cared for—what executive foresaw that in that short period of time the whole situation would be completely reversed, and we would find ourselves battling for our very existence. It is a fine tribute to the skill, ingenuity and courage of electric utility management that despite the tremendous decline in net revenues resulting from reduction in consumption of our product, despite huge and discriminatory taxes, despite sharp rate reductions forced upon them by public hue and cry, in most cases without economic justification, despite the large sums of money expended for unemployment relief, despite all this and much more, our industry has weathered the conflagration and emerged nearly whole.

Now we find ourselves facing a new order. New problems, such as we have never before been confronted with, are before us. Demands to the right of us, demands to the left of us, demands to the front of us volley and thunder. Consumers for more service at lower rates, government for more and yet more taxes, employees for higher wages and fewer hours, demagogues for out and out confiscation—and through it all we must maintain a high credit rating, so that the never-erasing requirement for plant renewals and extensions will be possible. It will take a stout heart and a resourceful mind to keep the ship on even keel.

Let us examine some of the new problems.

It is obvious at the present time that there are forces gaining headway in the direction of lower rates and higher operating expenses.

Pressure for rate reductions comes first from the public, which through political propaganda has been led to believe that rates are now too high. Pressure comes also from political and governmental sources for government ownership, behind which pressure there is undoubtedly the belief among politicians that public ownership of utilities would be a factor of tremendous political advantage. The recent appropriation of $400,000 to the Federal Power Commission for the purpose of studying costs of electrical distribution is an indication of how the political wind blows. The production of power by the government at Boulder Dam and Muscle Shoals will inevitably be used to set a fair rate bogey for private utilities, probably with little regard for real costs. From private sources competitive pressure comes in the form of machinery for isolated plants with lower first cost and more efficient performance than ever before.

Forces tending to increase operating expenses are found in nearly all of the governmental activities to bring about economic recovery. Higher prices for commodities, including coal, have already had noticeable effect. The NRA code will inevitably bring about increases in payroll.

Taxation is becoming heavier every year. In the calendar year 1932 the electric light and power industry paid approximately $217,000,000 in taxes, equivalent to more than 12 per cent of its gross revenue. The 3 per cent excise tax that became effective on September 1 of this year will take $35,000,000 more.

Current economic forces will affect utility capital structures in conflicting ways. The inflationary program of the federal administration, by raising the price level, will necessarily raise the legal fair value of the property used and useful in the public service and thereby establish a higher rate base. Against this influence, however, is the probability of low interest rates over the long range future. There are tremendous amounts of uninvested money lying in the banks which will seek investment as soon as conditions become favorable. As these vast amounts of money are released interest rates will inevitably go down, which condition will be reflected in the fair rates of return allowed by commissions.

**Abstract of address presented before the Pennsylvania Electric Association at its recent convention.*

On the whole, however, it is our hope that the rising rate base will more than offset declining interest rates, so that the net result will be to increase rather than decrease the net earnings permitted to utilities by the commissions.

Referring further to the capital structure, it is significant that after many years of development, in which the power industry absorbed billions of dollars for extensions, probably little or no new money will be required during the next two or three years. Experience has shown that the necessity for new money for the development of additional facilities in the public interest is a most important factor in obtaining public support. When new money is necessary both public and private influences co-operate to support an industry in the growth necessary to furnish the increasing service demanded by the public, and adequate returns on these new investments are willingly granted.

If, however, a time comes when the public demands for the products of that industry are met, so that the demand for new money is removed, public support invariably weakens and economic pressure against the industry builds up. Electric utilities are in this position at the present time.

Public relations

As in the past, future success for the utilities must be built upon a solid foundation of adequate service at reasonable rates. The term "service" includes both physical and personal service. That is, in addition to furnishing all of the electricity needed at all times under proper voltage and frequency conditions and with practical continuity, there must also be adequate personal service, which includes square dealing, sympathetic attention to the difficulties of customers, and courtesy at all times. Our reputation must be built upon the quality of our service, the reasonableness of our bills and courteous attention to the problems and wishes of our customers.

In general, electric rates at the present time are fair and reasonable. In a number of instances they are too low. Hence, especially in the face of the economic pressures above referred to, general rate reductions are out of the question. Nevertheless there is a prevailing belief among our customers that rates are too high. The best method of counteracting this belief is the efficient discharge of the responsibilities above referred to.

Contrary to the theory of some of our industry leaders who urge that we tell our story to the public, it is my belief that this cannot be done effectively.

Our business is a complicated one and the public is not interested in the complex details which must be grasped if our problems are to be understood. Furthermore, attempts to explain our side of the problem are only met with the contention that our opinions are biased; therefore they are unsound and of little value.

Let me repeat, it is only through the quality of service rendered and through square and courteous dealing with our customers that we can maintain our position.

Our service and our employees must be our ultimate good-will salesmen. The application of this principle should not, however, prevent us from being ready at all times to tell those who express an interest all about the problems of our industry.

Our physical service has been brought to a high degree of perfection. There still is and always will be room for further improvement in our personal dealings with our customers. This subject should be given special attention, both from the point of view of policies to be adopted and the training of personnel effectively to carry out the policies.

The depression has brought with it many critical problems in customer relations. Examples of these are the problems of delinquent bills and diversion of current. Hard times have hit all types of individuals, and we find involved in these problems not only the adventurer and knave, as heretofore, but many substantial citizens who had been good customers for years. Obviously different treatments should be accorded to different types. Attention may well be given to the possibility of classifying those accounts which are troublesome in order that each may receive the special consideration warranted by the special conditions involved. Mass treatment is unsatisfactory. Certainly our policies should compare favorably with the credit policies of department stores and other retailers.

Our customers are probably influenced as much by petty annoyances as by real trouble if not more so. Critical attention may well be given to analyzing the causes of petty annoyances and taking steps to reduce or eliminate them. It is in order to review rate schedules and the standard terms and conditions of service, with a view to modifying those elements that the past has shown to be causes of annoyance and misunderstanding. Unnecessary red tape should be eliminated.

The evident demand of the public for more strict regulation of public utilites is a significant force at this time and to a considerable extent an outgrowth of the depression. Utilities will continue to co-operate in all reasonable regulatory programs provided certain legal principles are observed. Utilities are a privately owned, not a publicly owned, business. They are subject to governmental regulation, not governmental ownership or governmental operation. Subject to regulation as to rates, service and facilities, they are free to conduct their business just as any other business is conducted. The failure or success of their business depends upon the character of management. Only the management is finally responsible for failure of service or failure to pay returns to investors and owners.

It is hardly necessary to suggest that utilities should take a constructive interest in the welfare of the communities they serve, for the progress and success of the utilities are absolutely dependent upon the progress of those communities. For this reason utilities are directly interested in the stability of employment and wages of their own communities and ultimately of the nation. Recognizing these factors in the program of the National Recovery Administration, practically the entire utility industry is placing its operations under the NRA codes.

Volume of business must be increased

A most essential immediate requirement is a substantial increase in volume of business. This is obviously necessary in order to recover the ground lost in the

depression and to make use of the excessive idle capacity now existing in our power systems.

The whole subject of rates and rate structures is a most important element in this problem. Obviously, rate structures must be so designed that they will produce the maximum volume of business possible with adequate net returns. To accomplish this they should be of such form as to inspire public confidence and encourage the use of current.

Rates must be understandable to public

Public confidence can be won most easily by simplicity and straightforwardness. Hence, rate forms should be as simple as practicable and such refinements as are necessary should be made clearly understandable to the user of current. It is often claimed that electricity should be sold on the same basis as groceries or dry goods; that is, at a flat price per kilowatt-hour, perhaps with quantity discounts. There is, however, a fundamental objection to this proposition which eliminates it from consideration. It does not establish a relationship between the size or capacity of installation and the number of kilowatt-hours used. Hence, it does not give the small consumer the advantages of high load-factor use of his facilities so that he will be influenced by the promotional feature of the low rate for incremental kilowatt-hours. The only method developed so far by which every user, whatever the capacity of his installation may be, can obtain the benefits of high load factor is the demand and energy form of rate. Of course, the demand charge may be in the form of a service charge or it may be spread over the first blocks of energy use. In either case the principle is the same and until some better form is developed the demand and energy type of rate will continue to be used. This form of rate, furthermore, has the distinct additional advantages that it protects in some measure the investment of the utility company in depressed business periods, and at the same time stimulates the maximum use of current at all times through the low energy rate.

Because of the large amount of idle capacity available, particular attention should be given to extending the field of application for electric power in our territories. Intensive study should be made to determine the economic conditions under which electricity can be used where it is not now used.

Value of service as rate base

In this connection more consideration may well be given to the value of electric power in different classes of use. Different values for different uses are established by convenience, economics and competition. Thus, in general, electrictiy for heat has a lower value than for power. Under our past practice in Pennsylvania, although value of service has always been given some consideration, primary emphasis has been placed upon the cost of service and the major classifications have been made in accordance with costs of service. Consideration of the value of service, as well as of its cost, may greatly extend the economic field of application for electricity, particularly under the conditions that will prevail during the next few years. The value-of-service principle is already well established in the freight rate structures of the steam railroads.

In developing possibilities for new business it may be found that some industries, because of the low price for their product now prevailing, are unable to operate under standard rates, but might get by with special rates until they could get better prices. Situations of this sort suggest temporary contracts for service under special conditions which could not be generally applied, but would not involve unreasonable discrimination.

In this intensive period of business building it will be most essential that the maximum possible volume of utilization appliances move into the hands of our customers. In bringing this about our policy may well be, on the one hand, to stimulate the sale of standard appliances by outside dealers, while on the other hand devoting our own efforts to introducing and popularizing new types of appliances that will create additional use of the service.

The competition of isolated plants will be keener than ever before. The small prime mover units available today have lower first costs and better operating efficiency than any heretofore available. The low fuel and labor costs now prevailing also favor the isolated plant. Competitive pressure is already being felt both in industrial and municipal fields. Our immediate problem is to ascertain the true significance of this competition and to accumulate comprehensive factual information as to just what it means. It is essential that accurate knowledge be gained of the true costs of power supply from small isolated plants of modern design constructed and operated at present cost levels. The possibilities of interconnection with industrial power plants producing electricity more or less as a by-product should also be given careful consideration.

With the amount of idle capacity now available it will not be necessary in the early stages of the business-building campaign to give special consideration to the elements of load diversity and load factor. These elements should, however, be studied, for in the long run maximum load diversity and load factor will be fundamental necessities in the power industry in order to obtain economical use of the large investments required in the service. It is not too soon now to begin studies and investigations to find ways and means of leveling out the daily and seasonal load curves so as to get the most efficient possible use of the investment in the power system.

There is still much to be done in electrification of the rural districts. This situation involves two fundamental difficulties. These are the present limitations in the use of electricity and the high average distance between consumers. Both of these make for low load densities involving relatively large investment and high cost of operation and maintenance.

While it is true that the rural dweller class admits of a somewhat higher use development than the urban class, it is also true that many have established rural dwellings for the specific purpose of reducing the operating expenses in the home. In farming operations the high demands over brief periods require unusually high equipment costs both for the utility and the farmer. The use or demand factor is among the lowest in any industry. Furthermore, the farmer is able to use portable power units in the form of internal combustion engines that satisfactorily meet many of his requirements.

All of these factors make for extraordinary difficulty in building up in the rural areas load densities high enough to yield a fair return at standard urban rates.

Further development must be in the direction of increasing rural use of current and reducing the costs of the investment and service. The problem is one both of selling and engineering.

It is hardly necessary to add that this entire problem of intensive business building calls for the closest possible co-operation by the salesmen, the engineers and the operators, all of whom must make their contribution if the maximum possible results are to be obtained.

The trend in operation

The economic forces above referred to obviously will exert pressure for more economical operation. The high standards of service that have been established, however, must not be sacrificed.

The future of our industry will depend largely upon the quality of service rendered. Of the qualities, continuity is one of the most important. The almost perfect continuity now maintained by most companies has been secured only at a tremendous cost. Possibly the cost of high continuity has in some cases outrun its economic value. Nevertheless, the cost of an interruption to service invariably amounts to many times the cost of the current lost through the interruption, so that the industry policy as to continuity must be based upon the losses caused the customer by interruption rather than upon the company's loss of revenue. Again, the tremendous improvement in the reliability of the equipment used in the generation and distribution of electric power is rapidly reducing the excessive costs formerly necessary in order to obtain reasonable continuity. It is our belief that continuity standards will be generally maintained at present or even higher levels, but that the cost of providing such continuity will be far less in the future than in the past.

It is a trite saying that utility companies are rendering a service rather than selling a product. It is nevertheless true and the fact necessitates a carefully selected operating personnel which must be maintained at a high morale.

The personnel requirements of a utility are far more exacting than those in many other industries. A high degree of initiative, loyalty and good judgment are absolutely essential. Our operating employees must be willing and ready to meet the emergency calls that may come at any time, and all employees must have the instincts of self-control and courtesy so essential in their contacts with customers and with the public generally. Adequate remuneration and safe and agreeable working conditions are obviously essential if high standards are to be maintained.

Now is the opportune time to plan for the future development of a personnel that will enable the utilities to maintain their service standards and friendly relations with their customers and the public generally at levels more nearly approaching perfection than ever before.

The development of such a personnel involves, among other things, careful selection and the proper training of new employees, frequent appraisals to determine whether the newer employees are measuring up to the standards set for them and a carefully planned system for both promotions and demotions to provide for efficient management and to aid in solving the problems of old age. Planning should also include a determination of future needs with respect to higher trained and skilled men, so that the organization is adequately manned, but not topheavy. Working forces will be increased, but should be carefully restricted, with due consideration to transfers within the organization, so that the organization does not become overmanned during a rise in business activity.

To the public generally the acts and words of our employees are the acts and words of our companies, so that the attitude of our employees is of vital importance in maintaining friendly relations with the public. With this thought in mind, the training of employees better to understand their own problems and those of the company should be kept continually under consideration to the end that appropriate programs of training may be carried on as found desirable.

One of the greatest factors in building morale in the operating organization is insistence upon high standards of safety in the work. Our companies in Pittsburgh have for a number of years placed extra emphasis on safety. The favorable reaction of this policy on the personnel has been very marked.

In developing and maintaining an efficient operating force yardsticks are of fundamental importance. Competition for the achievement of high standards is a most important means to their attainment. Some of the more obvious yardsticks for measuring operating efficiency are number and character of service complaints, number and character of failures of various classes of equipment, number and duration of interruptions to service. By giving careful attention to the subject it will be found possible to establish suitable yardsticks or units of measurement in almost all operating activities. The use of such yardsticks is an important factor in attaining continued efficient operation.

The more extended use of automatic equipment should have the effect of maintaining both operating efficiency and improving service. Furthermore, the supervision and maintenance of automatic operating equipment in general requires a high order of skill and therefore results in the employment of more skillful men to whom higher wages can be paid.

Engineering and system development

The downward pressure on rates and the upward trend in operating expenses further emphasize the necessity for making the most economical possible use of investment.

The large margin of idle capacity now present in most systems places the immediate emphasis on utilization of existing facilities rather than on the installation of additional plant.

At this time it is desirable to make an intensive engineering survey of the entire power system for the purpose of determining maximum load ratings for all elements in the system, from power station to consumer. By taking advantage of the operating experience of recent years, which has given us better knowledge both of the system load characteristics and the performance characteristics of the equipment, it will be found that many if not all parts of the system may now be operated safely under duties that formerly would have been considered hazardous. A survey of this sort is bound to yield valuable results and will probably make it possible to delay for one or more years substantial investments in equipment that would otherwise be made.

At the same time, however, engineering development work should go forward with a view to making system

additions when necessary in such a way as to yield the maximum possible system capacity for every dollar spent. The higher reliability of electrical equipment now available, together with improvements in system protective equipment, are rapidly revolutionizing the design of power systems. Spare capacity and duplicate equipment requirements are being rapidly reduced as reliability of equipment improves. It was largely because of this fact that the statement was made above that high continuity of service would be maintained in the future at less cost than in the past.

In the past the policy of playing safe in meeting expected load increases with plant extensions was permissible, because one could feel sure that even though the load did not develop immediately, the plant would certainly be loaded in a very short time. Now future extensions will be made more deliberately, only after their need has been firmly established. There will be no major extensions until existing plant has been fully utilized.

The cost of engineering is an important item in the utilities' economic picture. While the business was growing the function of our engineering staff was to utilize the money devoted to system improvements in such way as to give the greatest possible returns. Under present conditions the chief responsibility of the engineering staff is to save money through adaptation of existing facilities to new requirements. Yardsticks may be found to measure engineering as well as operating results. Lower unit costs of new investment, more efficient utilization of present investment and the bringing about of operating economies through engineering analysis are some of the yardsticks by which engineering efficiency may be measured.

Particularly in the smaller jobs does engineering become an important item of cost. In this field attention can well be given to simplification and standardization of design and of materials used, as well as of the forms by which construction information is put into the field. In this way much drafting work can be eliminated, with substantial economy resulting.

In order to apply the above principles, our engineers must broaden their point of view and become conversant with the major economic problems of the power business as well as with the design and operation of the physical plant. The executives must see to it that this is accomplished through inspiration and example.

Policy guiding replacements

The problem of replacements must be given careful consideration. It is probable that in general the average efficiency of generating equipment is as high as economically warranted in view of the characteristic of the load duration curve. Put in another way, the expenditure of new money for more efficient peak-load plants is not in general justified. The operating efficiency of transmission and distribution plant cannot be materially improved, so that if present plans is reliable, replacement is not justified. Hence, replacement must be chiefly confined to the renewal of those parts of the system which have actually depreciated to the point where the service is subjected to undue hazard or operating and maintenance costs have become excessive.

The problem of depreciation reserve must be considered in connection with the rate of growth of the system. Theoretically, as the rate of growth decreases, straight depreciation requirements will absorb a larger portion of the annual revenue, a condition which continues for a number of years after growth has ceased. On the other hand, many of the replacements made on a growing system, as for example line conductor and circuit breaker capacities, are made necessary by the growth and would not be required if it were not for the growth. These two conflicting influences tend to offset each other. Nevertheless, the knowledge of these influences suggests necessity for careful study of the depreciation problem and readjusting of deprecitaion policy where found desirable.

I have endeavored to give you a brief survey of the problems that confront us. In appraising the situation in which the power industry now finds itself the necessity for well-balanced management stands out more than ever before. Utility management has a threefold responsibility:

1. Responsibility to the public for adequate service at reasonable rates.
2. Responsibility to the employee for fair and safe working conditions and reasonable wages.
3. Responsibility to the stockholders for an adequate return upon their investment.

The years immediately ahead will be years of great difficulty for our industry. There will be conflicting pressures from the public, the employees and the owners of the properties. There will be great responsibility upon our managements and ultimate success or failure will depend upon the extent to which these three major responsibilities have been properly discharged so that a suitable balance is maintained in the relationships of the three groups to whom management is responsible.

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Comparing Stack Outputs of Neighboring Plants

That a generating station carrying 127,000 kw. of peak load may produce less stack discharge in the form of cinders than a nearby plant carrying 11,000 kw. was the burden of testimony by John Hunter, consulting engineer, St. Louis, Mo., in a recent hearing before a master at Boston in a suit against the Edison Electric Illuminatnig Company by residents of Quincy for alleged damages from soot and cinders. Mr. Hunter testified that although the Edison company's Edgar station burns five times as much coal per hour as the plant of the Eastern Massachusetts Street Railway on the opposite side of Fore River, it by no means follows that cinders are emitted from the Edgar stacks in proportion to the amount of fuel consumed. The amount of cinders rising from a square foot of grate surface depends on the weight of coal burned on that area, upon the velocity with which the air rises and upon the circumstances of combustion. The Edison station burned but 1 lb. of coal per kilowatt-hour generated, compared with 2.15 lb. in the railway plant.

Mr. Hunter pointed out that the capacity of the coal-fired boilers at Edgar station is 160,000 kw. and of the

railway plant 11,000 kw. The under-fire air pressure is 2 in. at Edgar and 3 in. at the other station. Assuming that poth plants use coal with 5 per cent ash, 10 per cent of the coal will be refuse. The railway plant will then have 2,370 lb. of refuse per hour and Edgar 12,700, when operating on the foregoing peak. Edgar station would then have a 7 per cent soot and cinder loss and the railway station 14 per cent, because the latter is operating at the maximum capacity of its boilers and stokers. Per pound of coal burned, the railway plant would produce double the amount of cinders delivered by the Edgar station. About 25 per cent of the refuse would go toward the stacks at Edgar, or 3,180 lb., and from 35 to 50 per cent of the refuse at the railway plant, or 830 to 1,115 lb. As the Edgar station utilizes cinder catchers (both Carty and Sturtevant), an allowance of 75 per cent efficiency in cinder removal may be made, leaving but 795 lb. of refuse per hour discharged from the Edgar stacks, against 830 to 1,115 lb. from the railway station, which has no cinder catchers.

Although the Edgar station does not use pulverized coal, Mr. Hunter added the following comments on the disposition of refuse from powdered fuel. He stated that with this type of fuel about 80 per cent of the refuse goes up from the boiler furnaces in a well-designed plant. If a Cottrell precipitator is used, the maximum amount of waste material which can be removed is about 92 per cent, but as this equipment is built to reach its normal loading at the usual running capacity of the boilers, the peak load removal capacity of the precipitator is from 75 to 80 per cent. If an average efficiency of removal is taken as 90 per cent, 10 per cent of the 80 per cent refuse (or 8 per cent) will be left as stack discharge. With a stoker plant about 25 per cent (maximum) of the refuse goes up, because most of the refuse is caught as gross solid material in the ashpit. If dust catchers remove 75 per cent of the waste material from the stack flow, only 6 per cent remains. Pulverized coal, Mr. Hunter said, discharges more dust into the air than bituminous coal under stoker firing, and this dust will generally pass through a 300-mesh screen.

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Manufacturers Grouped for Code Administration

For the smooth functioning of the NRA code covering electrical manufacturers, it was decided by the board of governers of N.E.M.A., at its meeting in Cleveland the week of September 26, that the industry would be divided into the seventeen classifications shown herewith. These group manufacturers who have common interests and common problems. Over each of these classifications there will be a supervisory agency, consisting preferably of one person (in exceptional cases three to five persons), which will be responsible for and have sole authority to enforce the code in that particular group.

The object has been to reduce the number of classifications to a minimum consistent with satisfactory operation, since thereby there results increased certainty that the power conveyed to supervisory agencies will be wisely and effectively exercised, first through the higher average of qualification, second through increased tendency toward impartiality, and third through ability to co-ordinate.

As a means of accomplishing a desirable organization, it has been suggested that each section in a classification might choose one of its members to represent it on an advisory committee to the supervisory agency. The advisory committee shall then select by secret ballot from its own membership or otherwise the supervisory agency to be recommended to the board. Suggestions were made for selecting the supervisory agencies in case of disagreements. The selection of the supervisory agencies is the next step and will proceed promptly.

Classifications Determined by N.E.M.A. Board of Governors

1. **Installation Devices** — Wiring devices (attachment plugs, lamp receptacle and sockets, snap switches, fuses); knife and enclosed switch; small air circuit breaker; panelboard and distribution board; signaling apparatus.
2. **Appliances**—Domestic and commercial cooking, heating and motor-driven appliances; fan motors.
3. **Refrigeration.**
4. **Radio**—Radio receiving tube section.
5. **X-Ray and Electro-Medical Apparatus**—Sun lamp section; vapor lamp section; X-ray and electro-medical section (X-ray group, electro-medical group).
6. **Industrial Apparatus** — Electric welding and welding wire; industrial control; motor and generator; industrial heating.
7. **Construction Material** — Electrical porcelain; insulating material (laminated phenolic products, manufactured electrical mica, molded insulation, varnished fabric and paper, vulcanized fiber).
8. **Electric Transportation Section** — Trolley car and bus motor and control group; electric fittings for trolley cars and buses group; heavy traction group; oil and gas-electric locomotive group; gas-electric rail group; mining and industrial locomotive group (coal cutters, underground loading machinery); overhead trolley line materials group.
9. **Generation**—Prime movers section (small turbine group, diesel engine generator set group, gas-electric set group).
10. **Transmission and Distribution Apparatus**—Electric meter and measuring instrument section; high-voltage insulator; switchgear (distribution cutouts, large air circuit breaker, oil circuit breaker, power switchboard, power switching equipment, connectors); transformer (capacitors); pole line hardware; underground fiber conduit.
11. **Illumination** — Commercial lighting; display and window lighting; industrial lighting; flood lighting; street lighting; reflectors (silver mirrored and glass, prismatic, metal, porcelain, continuous metal troughs).
12. **Roughing-in Material**—Non-metallic conduit, outlet, switch box and conduit fittings; surface raceways; rigid conduit; under-floor duct.
13. **Wire and Cable** — Armored conductor and flexible metallic conduit; non-metallic sheathed cable; flexible cord; magnet wire; bare and weatherproof wire; paper cable; varnished cambric cable; alloy wire; bare wire shapes; rod manufacturing; coil; automotive; asbestos, insulated power cable; rubber power cable; rubber-covered building wire.
14. **Dry Batteries and Flashlights** — Dry batteries and flashlights; carbon and anodes.
15. **Specialties** — Electronic tubes; small charging, ignition and battery testing equipment; specialty transformers; small fixed condensers.
16. **Electric Tools.**
17. **Telephone Manufacturers.**

Installing Dampers and Reinforcing on "Hot" 132-Kv. Line

By R. H. HALPENNY

Electrical Engineer, Southern Sierras Power Company, Riverside, Calif.

WHEN investigation revealed broken strands due to conductor vibration at some of the deadend clamps in the No. 4/0 A.C.S.R. on the 222-mile, 132-kv. Southern Sierras Power Company line which provides construction power to Boulder Dam the decision was reached to install Stockbridge vibration dampers throughout the entire length of the line. In addition to preventing further vibration damage, a plan was worked out whereby existing damage was corrected by reinforcing the cable at the deadends where broken strands existed. This work was completed in August without interruption to service and without accident by a crew of four men, two linemen and two groundmen, with a truck especially equipped for the job. In less than three months approximately 3,000 dampers were installed and cable reinforcing applied to some 40 deadends.

Although working lines of this voltage "hot" is common practice, some of the tools and operations in this particular job were developed especially for the conditions to be met and hence may be of interest to construction and operating men faced with problems of a like nature.

The Stockbridge vibration dampers were placed at a distance of 30 in. from the deadend clamp, the exact location being marked by means of a light-gage iron carrying a paint brush which had been dipped into a red lead mixture, the whole assembly mounted on the end of a "hot stick." A special tool (Fig. 1) consisting of two members was developed for the application of the dampers. A clamping device held the damper in place while a ratchet-type socket wrench operated the cap screw that controls the jaw of the damper clamp and fastens it securely to the conductor. A 1½-in. treated stick, 12 ft. in length, carried the entire assembly, while a lighter stick operated the wrench through a ball-and-socket joint. By rotating the main stick the tool would clamp or release the damper as desired.

Since the weight of the tool and damper was too great to be supported horizontally on the end of the stick by a man, a boom and hanging line was used to support it

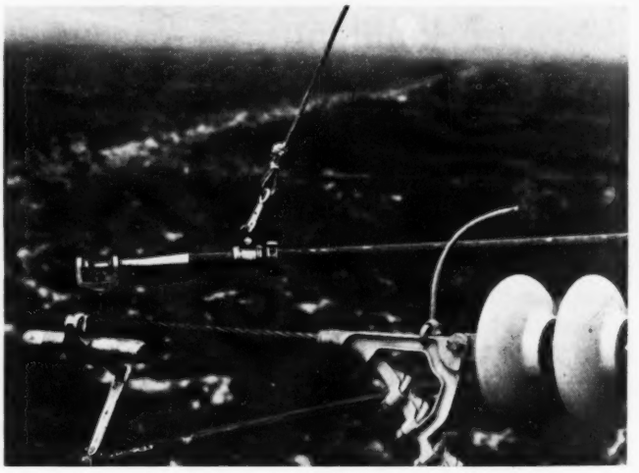

Fig. 1—Placing Stockbridge dampers

A special tool was used, one member of which held the damper clamped in place and a second, consisting of a ratchet-type socket wrench, tightened the bolt.

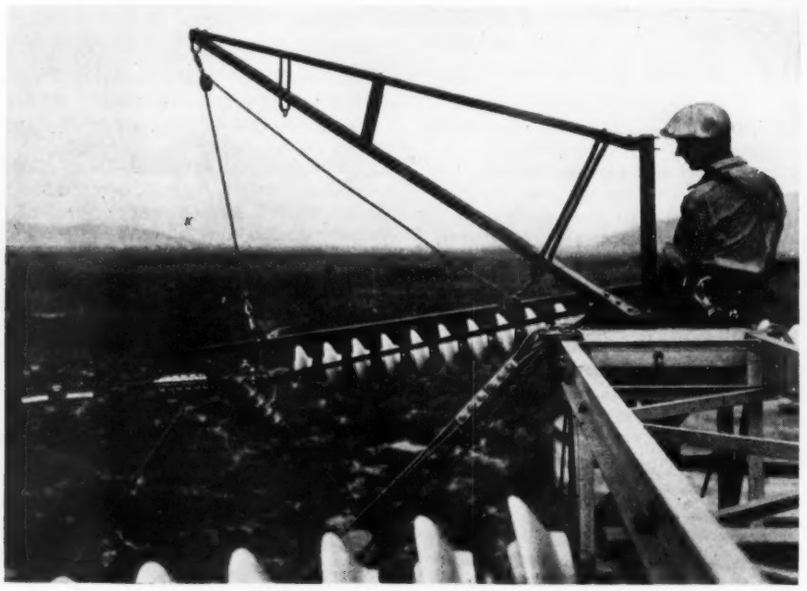

Fig. 2—Boom carries weight

A portable boom which could be mounted on the tower carried the weight of damper or clamp and tool. Here the reinforcing clamp or "comealong" is being installed.

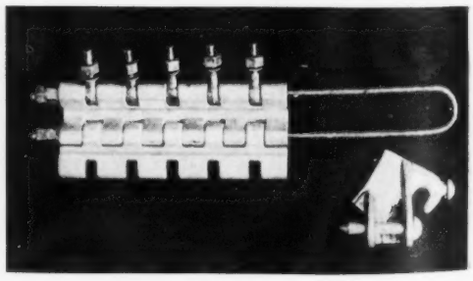

Fig. 3—Reinforcing clamp

A malleable iron hook casting was designed to be placed on deadend clamp and rivet inserted. The Aluminum Company reinforcing clamp or "comealong" consisted of two halves fitted to a ½-in. iron shackle which was placed over the hook casting. One-half rotates on one leg of the shackle. Hinged bolts on the other leg fit into the slots when the clamp is closed around the conductor.

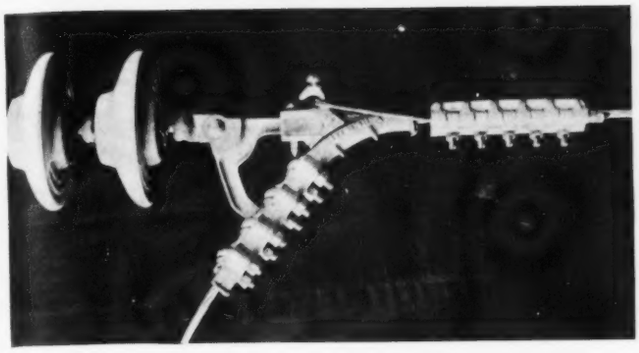

Fig. 4—Completed reinforcing assembly

With the shackle engaged in hook and clamp firmly bolted to conductor, stress is applied by tightening the bolts on the end of the shackle.

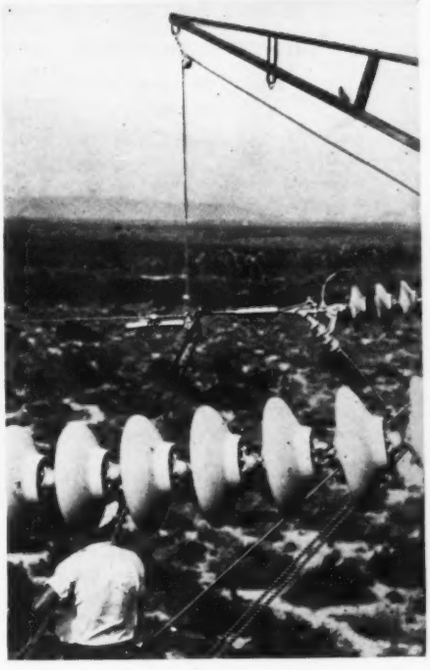

Fig. 5—Finishing touch

Lineman on safety platform applying take-up on the shackle bolts while hot line tool is suspended from boom.

during the application of a damper (Fig. 2). The boom consisted of a treated wood bolted to thin steel plates, which in turn were welded to a short steel tube. In mounting the boom the tube was merely slipped over a vertical pin of heavy Shelby steel tubing, which was fastened to one of the tower members.

At the time dampers were installed at deadends the conductor was carefully examined for broken strands. To facilitate inspection of strands lying within the bell of the deadend clamp a small convex mirror mounted on the end of a hot stick was used to advantage. Where broken strands were found the conductor was reinforced.

Instead of developing a special reinforcing clamp it was decided to employ the Aluminum Company's "come-along" clamp (Fig. 3), provided suitable means could be devised for attaching it to the deadend clamp. This was accomplished by designing a malleable iron hook casting which would fit securely over that portion of the deadend clamp normally horizontal and which could be held in position with a ½-in. rivet serving as a locking pin. A rivet-shaped head on the casting permitted it to be placed in position with the same hot tool that inserted the pin (Fig. 3). The completed reinforcing assembly (Fig. 4) was extremely satisfactory.

Because of the difficulty of applying the reinforcing clamp to the conductor with all work conducted from the tower, it was considered advisable to use a safety platform which permitted one lineman to work from a position below and in front of the clamp. The "come-along" was placed in position with a special tool, which gripped the aluminum body with three pins, two fixed and one movable. To release the clamp from the holder an eye in the movable pin was engaged by a hot stick hook. In placing the clamp it was necessary to employ the boom, as in the case of the damper, on account of the weight of clamp and tool.

With the clamp held in place on the conductor, the lineman on the tower closed it with a hot stick, while the lineman on the safety platform drew the tightener bolts in place and tightened them with a socket-wrench type of tool. To insure that all of the cable strands, including the broken ones, were stressed sufficiently to develop the full strength of the cable a small amount of take-up was applied to each clamp. This was obtained by tightening the nuts on the ends of the shackle bolts with a ratchet-type socket wrench fitted to hot stick handles (Fig. 5).

For transportation of men and equipment a 1½-ton truck was fitted up with special tool compartments of weatherproof construction on each side of the bed and the space between utilized for storage of dampers, clamps, platform and boom.

Progress of installation depended upon ease of transportation. Some sections of the line could not be reached by truck and all tools and equipment had to be carried to the towers by the working crew. Despite such handicaps the average rate of installation was 36 dampers per day, with a maximum record of 60. Since dampers were only placed on deadend towers and on one side of suspension towers adjacent to deadends this rate was considered highly satisfactory. Reinforcing clamps required an average of 30 minutes for installation.

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Knock-Down Table for Relay Tests

By RALPH ENGSTROM
Meter Department
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Testing relays in service requires the use of a number of instruments and associated apparatus that have been combined in various ways for convenience and speed in working-carrying cases, for instance, that open out like folding beds with all the equipment in place ready for connection. But these assemblies are rather expensive when relay testing is a comparatively infrequent job. Generally the tester loads up his car with meters, load boxes and rheostats and goes out to the job. Then if he wants to avoid cramps in his legs from squatting or kneeling down to read and manipulate his apparatus on the floor he spends a few of many minutes hunting for a box or a table to set his equipment on, finds something, or he does not; in either event he has lost time. This loss of time does not occur in relay testing on the system of the Central Illinois Electric & Gas Company. The tester's equipment includes a small, low-priced typewriter table with the legs made demountable. Then when the tester gets on the job he simply sets up the table and is ready to go with his slide wire rheostat and testing switches, permanently fixed to the table top.

Semi-Automatic Operation Obtained at Low Cost

By L. M. ROBERTSON
Transmission Engineer,
Public Service Company of Colorado, Denver

Small stream flow plants modernized to save fuel at steam stations. Automatic operation improves reliability of service.

IN CARRYING out its modernization program, one phase of which has already been described (ELECTRICAL WORLD, June 17, 1933, page 805), the Public Service Company of Colorado was confronted with the problem of utilizing the output of two small hydro plants efficiently and economically. Both of these plants are connected to the central system of the company, which system is made up of an interconnection of plants with 100-kv. transmission lines, as shown in Fig. 1. Summit and Fall River hydro plants supply power to the towns of Dillon and Idaho Springs, respectively. It will be noted that the size of these plants is relatively small compared with that of the system, although their capacity is valuable to the local districts in case of separation from outside sources of power.

Built in 1909, the Fall River plant has two 300-kw. generators supplying power for mill and mine operations. Recently it was leased to the Public Service Company of Colorado, which installed semi-automatic control equipment to make the plant run on a stream-flow basis attended by one employee who lives at the plant. Since this plant is connected to the central system, its particular value is its kilowatt-hour generation, which offsets the cost of coal at the steam plants on the system.

In adapting this plant for automatic control on the stream-flow basis a rather unusual method was employed to reduce the investment involved in equipment. The waterwheels of the generators are of the single-runner type with hand control on the needle stem, the governor operating a deflector in the water stream. In order to make this plant automatic it was necessary to provide a drive for the needles. This was accomplished inexpensively by using a motor-operated valve control which moves the needle through a sprocket-and-chain drive. The motor drives gearing through a worm, which is normally held in position by a thrust spring. When the needle closes or meets an obstruction the worm will move against the thrust spring, opening the limit switch on the shaft of the worm, thus stopping the motor. The mechanical layout of this construction is shown in Fig. 2.

Bridge circuit used for control

Control for the needle motors is based on a bridge circuit (Fig. 3) with a rheostat at the forebay and a rheostat coupled to each needle. The rheostats form a variable resistance, control wires being provided between the two points. As long as the float in the forebay remains at a certain position no change in the circuit will be made and the needle positions will remain constant. Should the water level change the rheostat at the forebay moves from its position, unbalancing the circuit, which causes the balance relay to operate, changing the needle positions until balance is obtained.

Fig. 1—Semi-automatic hydros save coal for Public Service Company of Colorado

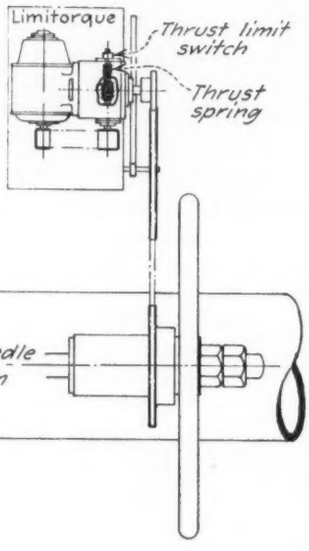
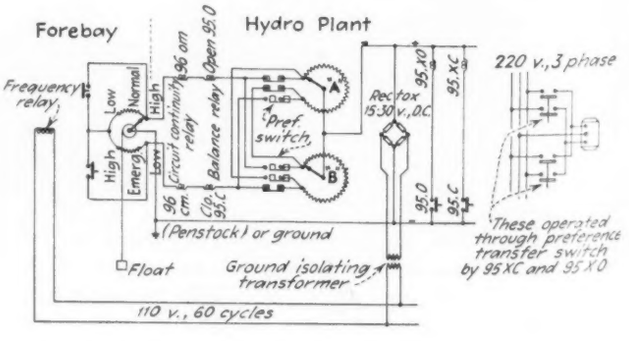


Fig. 2—Motor drive applied to the needles of the Fall River water wheel jet

Fig. 3 — Simplified control circuits for an inexpensive semi-automatic control installation

Designed for stream flow operation, three rheostats, one at the forebay and actuated by a float, and one at each machine, form a balanced circuit, changes in which operate relays to readjust the needle openings for balanced operation.



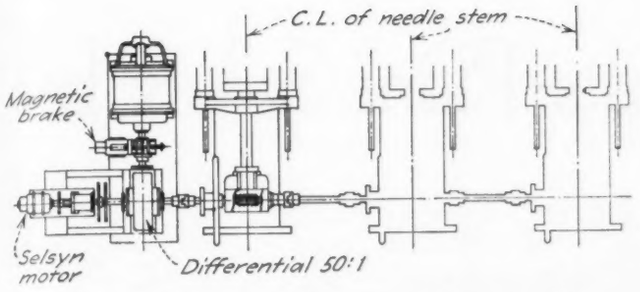


Fig. 4—Selsyn-controlled, motor-driven needle stem operators applied to the triple-runner machines at the Summit plant

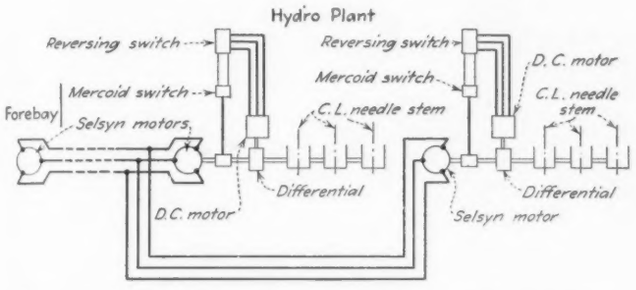


Fig. 5—Simplified schematic diagram of the control of the machines at Summit plant

Balanced stream flow operation is provided by arranging the Selsyn motors at each machine to operate Mercoid switches and thus readjust needle positions until the water in the forebay returns to its proper level.

Emergency operation is provided for by means of a frequency relay at the forebay. Contacts of this instrument are normally closed, short circuiting the emergency section of the rheostat. Should the frequency drop these contacts open and contacts on the "normal" side will close, short circuiting the resistance on the "normal" side and causing the machines to pick up load and provide emergency capacity for the district. A preference switch is included at the plant so that either machine can be loaded up first, depending upon the position of this switch. The application has been entirely satisfactory for the purpose for which it was intended.

Amortizing the cost of the automatic equipment over the period of the lease and paying the operating costs, which include the wages of an attendant living at the plant, the cost per kilowatt-hour at this plant has been competitive with coal costs at the steam plants. Thus additional capacity in the Idaho Springs district has been obtained for a very reasonable cost, which could have been justified only by the use of this extremely simple semi-automatic control. Obviously, the cost of three shifts of operators for such a small plant would have been prohibitive.

Three needles similarly controlled

Conditions surrounding the modernization of the Summit plant are very similar to those encountered at Fall River. Summit likewise has proved to be valuable as standby capacity for the district when the town of Dillon is separated from the 100-kv. system. The plant, flumes and distribution system are all managed by one man, and the property was in such a bad state of repair when it was acquired by the Public Service Company of Colorado that immediate improvement was required. It was questionable whether or not the plant could be kept in service and the investment held intact and still pay the costs of maintaining the property and bringing it up to satisfactory conditions. A number of investigations were made and it was finally decided to install a semi-automatic control equipment similar to that in the Fall River plant.

The two machines in the Summit plant have three needles and runners per machine. This, therefore, somewhat complicated the control of the needles, the governor on these machines also operating on a deflector in the water stream. A scheme was worked out whereby a "Selsyn" motor was installed at the forebay and connected to a float. At each of the two machines another Selsyn motor was installed. These Selsyns operate "Mercoid" switches in the control circuit of the motor which drives the needles through a worm gear. When the Selsyn at the forebay takes up a new position the receiving Selsyns at the machines operate to close the Mercoid switches on the motors driving the needle stems. When the water in the forebay has returned to the proper level the Mercoid switches open and stop the motors, leaving the needles in the position of balanced operation with reference to the forebay water level. Mechanical and electrical connections for this installation are shown in Figs. 4 and 5.

In modernizing these two small hydro plants it should be noted that the protective equipment consists only of short-circuit protection of the generators. Past experience has indicated that bearings and windings on these slow-speed machines give very little trouble over long periods of time, and it was felt that elaborate relaying equipment to protect against these various failures was not justified.

By devising this inexpensive automatic control for these small hydro plants it has been possible to reduce expenses, make much needed repairs to the system and save fuel without decreasing the payroll. In addition to making these plants more reliable, this work has proved a very efficient way of protecting the investment in small hydro plants and obtaining power at a very reasonable cost.

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Removing Competitive Situation

In many instances where utility customers have had reports prepared for them as to the advisability of installing their own generating plants a good proportion of the savings indicated could be effected without installing the generating plant and with but few changes in their existing equipment for furnishing steam for heating and process work. "In several such instances," says H. C. Thuerk, Utility Management Corporation, "it was found that if recommendations were made to effect decreased operating costs of this nature before consideration was given to the installation of generating equipment the amount of savings to be obtained through the installation of the generating equipment alone did not justify its investment. It would therefore be a very wise policy for each company to make sure that each of its present customers who is in the competitive class is obtaining and utilizing power and heat in the most economical manner. Such a procedure will make it much easier to deal with competitive power situations when they ultimately develop."

Dairy Products Plant Saves by

By L. V. GLAVINOVICH

Electrical Engineer
C. C. Moore & Company, Engineers,
San Francisco

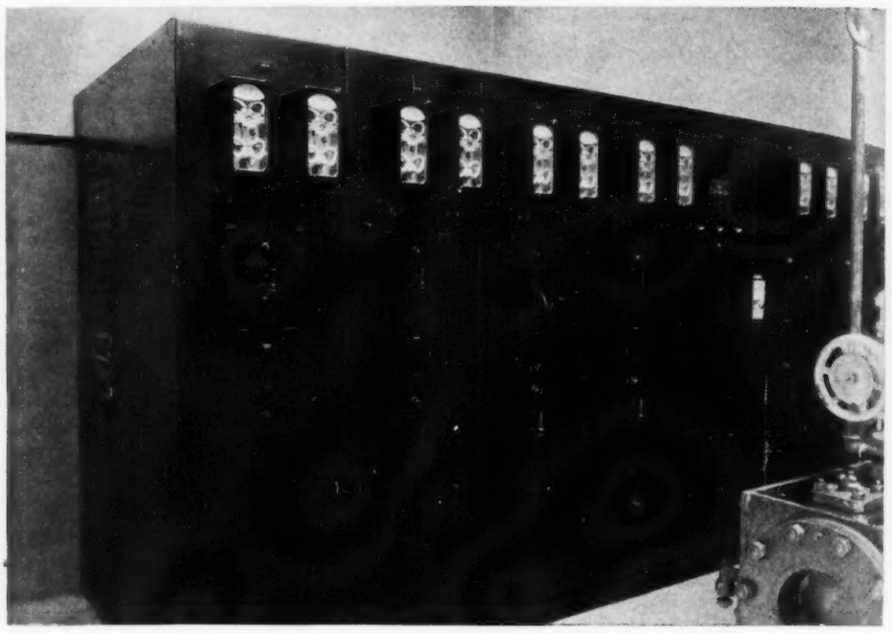
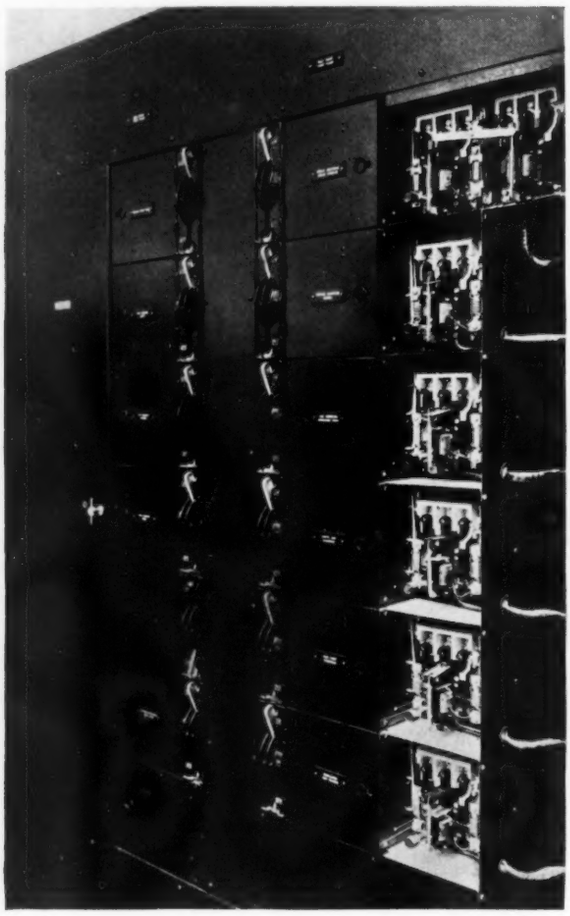


Fig. 1—Simplicity and safety are characteristics of this modern steel construction

This main switchboard is composed of eight two-circuit panels and one central instrument panel with ground-detector lamps.

Fig. 2—Characteristic section of distribution switchboard

Down the center of this section extends a vertical bus flanked on each side by a row of receding-blade fusible-blade knife switches, a row of magnetic switches and a wiring gutter. Flexibility of this construction is illustrated by the reversing magnetic switch installed over the standard magnetic switches. Practically any combination of circuits and control is obtainable. Buses serving adjacent sections of these switchboards are horizontally supported in the upper or lower inclosures.



AT THE new plant of the Dairy Delivery Company, San Francisco, Calif., careful consideration in design insured maximum economy and convenience in operation and maintenance. This plant, which replaces a number of smaller units, has a maximum daily capacity of 90,000 gal. of milk and makes wholesale and retail delivery of dairy products and byproducts. Modern machinery and methods insure the highest standards of quality, and the plant layout not only makes for high operating efficiency but also provides for an accurate check on the cost of operation of each operating department through a well-planned arrangement of the electrical circuits.

The plant is arranged in four sections, each of which is subdivided into one or more units or departments, each plant unit being supplied by a separate feeder from the main switchboard.

Units comprising the first section include the power plant, ice-making plant, milk plant, byproducts plant, laboratory, office units Nos. 1 and 2, laundry, cafeteria, office elevator, emergency lighting and electric sign. The second section, known as the loading shed, covers a ground area of approximately 50,000 sq.ft. and consists of four concrete driveways, each of which can accommodate a double row of wholesale and retail delivery trucks and a complete system of conveyors necessary for the loading and delivery operations. The conveyor system is arranged with hinged sections and reversing sections to give complete flexibility. The third and fourth sections are made up of the blacksmith shop, auto shop, paint shop and the ice cream plant.

Services to each of these units or departments are individually metered to permit accurate accounting and

Centralized Operations

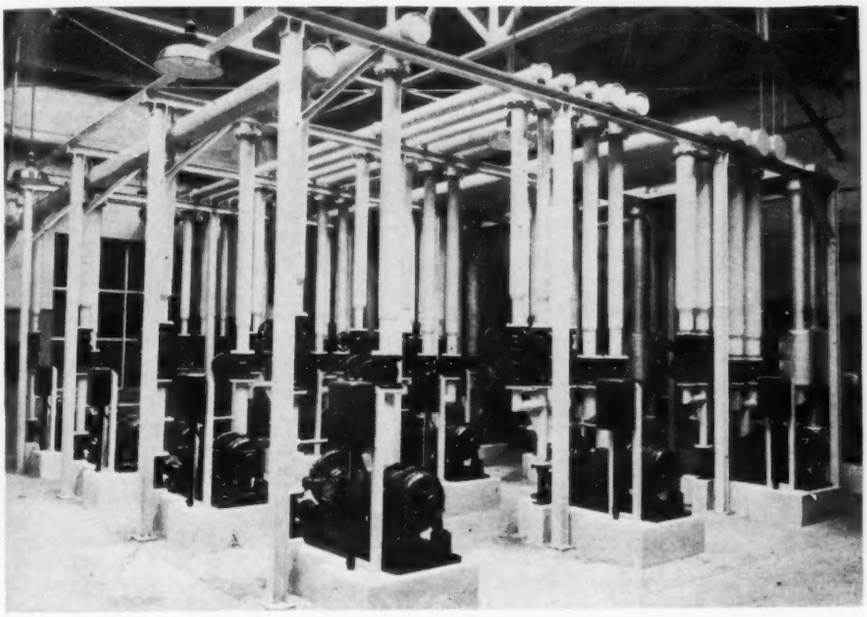


Fig. 4—Centralized pumping system consisting of sixteen units

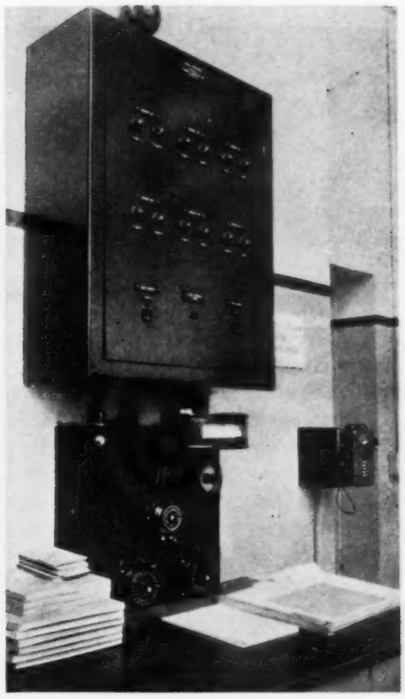


Fig. 3—Call-and-answer board permits centralized grouping of all pumps

This increases efficiency and promotes economy in equipment and labor.

cost compilations. Power is supplied through an 11-kv., three-phase underground cable to a bank of three 200-kva. transformers located in a transformer vault adjoining the compressor room in the power plant. The 460-volt, three-phase secondary from the transformer vault to the main switchboard located in the compressor room consists of two 1,000,000-circ.mil, paper-insulated, lead-sheathed cables per phase, one cable of each phase being installed in each of two 5-in. soapstone ducts. One spare 5-in. duct provides for increasing the capacity by 50 per cent. In the plant design the locations of the transformer vault and the main switchboard were so arranged to make the cable run between them as short as possible, the length of run being approximately 60 ft. This location was selected after careful consideration of convenience in operation and economy of installation with respect to the center of distribution.

The main switchboard is of a dead-front type composed of nine one-piece steel panels, eight of which control two feeder circuits each. Each circuit is equipped with individual fusible knife switches and watt-hour meters. Feeders supply both light and power and all are three phase with the exception of three supplying comparatively small single-phase loads. On the central panel of the main switchboard are mounted the curve-drawing voltmeter and ground detector pilot lamps on the 460-volt bus. Ground detector lamps give dim indication for the normal ungrounded system, indicating a ground on any phase by the brightness of the lamp on that particular phase.

Because the ceilings, walls and floors, as well as all equipment, in the milk and byproducts plant are washed daily with steam and water and because such plants liberate lactic acid vapors, moisture and corrosive conditions were given careful consideration. Feeders from the main switchboard are carried underground only in the power plant and compressor room, lead-covered cable being used. In general, conduits from the main switchboard terminate in the passageway adjoining the compressor room and run overhead to eliminate the corrosion at floor lines which is experienced under the severe operating conditions outlined above.

Feeder circuits terminate at distribution boards located throughout the various buildings of the plant. The distribution boards are located adjacent to centers of distribution, but in places where there are no moisture and corrosive vapors.

Distribution switchboards are completely inclosed,

Fig. 5—Underground circuits terminate in steel pull boxes

From these pull boxes overhead conduits are extended for plant distribution as water and corrosive vapors present in dairy products plants make overhead distribution necessary.

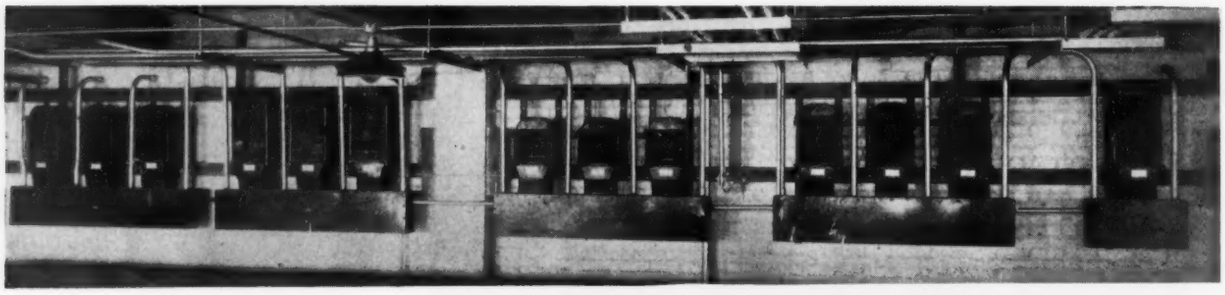


Fig. 6—Dry-type transformers mounted conveniently in otherwise unusable wall space

Supply lighting and small power with 115/230-volt, 3-wire service.

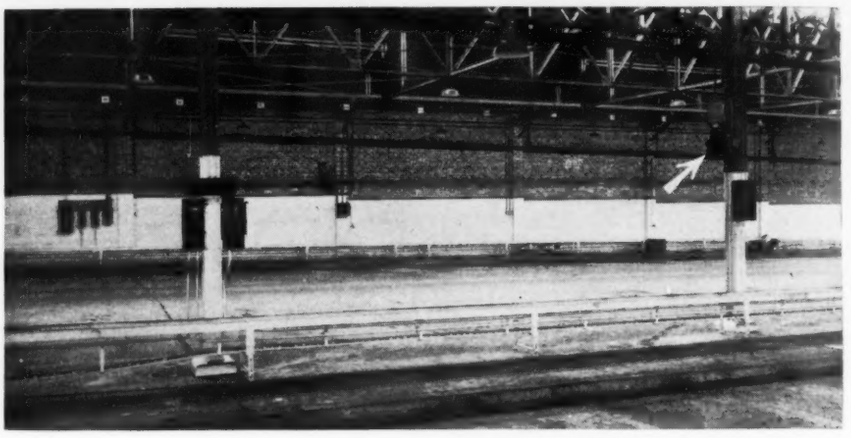


Fig. 7—Control equipment in loading shed

On the column at the left is the control for the conveyor. On the column at the right is a lighting cabinet served from the individual dry-type transformer indicated by arrow. Similar equipment for the next bay may be seen on the wall in the background.

dead-front, steel switchboards arranged for mounting directly against the wall with all buses, connections and equipment accessible from the front. The branch circuits are controlled by Trumbull receding blade fusible knife switches approved by the Underwriters' Laboratories for 440-volt motor circuits. The receding blades operate at right angles to the cover plate of the unit so that the handle is practically flush with the cover plate in either position of the switch; this reduces the size of the fusible switch unit to a minimum and virtually eliminates all projections from the front of the switchboard.

The distribution switchboards comprise an assembly of sections, each consisting of a vertical bus with one vertical row of seven 30-60-amp. convertible fusible switch units with magnetic switches and a wireway on each side of the vertical bus. Each section is therefore suitable for the control of fourteen circuits. By using the unit assembly extreme flexibility is provided for in the arrangement of circuits, groupings being made in units of seven circuits or multiples thereof. The buses supplying the distribution switchboards are horizontally mounted, located either at the top or bottom of the switchboards in inclosures common to all units. Vertical wireways adjacent to each unit include special construction wherever necessary for mounting reversing magnetic switches, small transformers for low-voltage control circuits and other special provisions necessary for individual circuits. As both the 100-amp. and 200-amp. fusible switch units require space equivalent to two 30-60-amp. convertible fusible switch units, any required combination is available. Where seven or less switch units are required for any distribution switchboard the vertical bus and one row of units are used with spare units or steel construction providing for future expansion as required. The use of distribution centers of the type described is practically universal in this plant, the only deviation in this practice being in places where only a few circuits are required, in which case the distribution centers consists of fusible safety switches mounted in individual cases.

Of particular interest is the method in which lighting and small power load are supplied from 115/230-volt, three-wire, a.c. circuits. The transformer installations supplying these circuits are unusual, not only because dry-type transformers are used, but also because special approval was required for the installation of 15-kva. transformers of this type, 10 kva. being the maximum rating permitted by national and local regulations. The use of dry-type transformers for the lighting and small power loads proved to be extremely satisfactory. Lighting and small power loads for each unit of the plant are supplied from the main power feeder serving that section.

Larger loads in the main building are supplied from transformer banks connected three-phase, 460 volts delta to six-phase, 115/230 volts, seven-wire star with a grounded neutral. Each bank feeds a three-section lighting cabinet, each section being connected to one 115/230-volt, three-wire feeder. Power supplied to each lighting cabinet therefore consists of three $1\frac{1}{4}$-in. conduits, each having three conductors supplied directly from an individual transformer bank. For the smaller lighting and power loads in the main building and other sections of the plant a single-phase transformer is used for each lighting cabinet.

This lighting system limits single transformers to a maximum of 15 kva., but provides for transformer banks having a maximum of 45 kva. and maintains uniform lighting panels throughout the plant. By using transformer banks with the six-phase, seven-wire system for the larger loads the conduits for the lighting cabinet feeders were standardized at $1\frac{1}{4}$ in., the maximum size which could be embedded in the $3\frac{1}{2}$-in. concrete floor

slabs of the office portion of the building. The use of any other lighting system would have required larger conduits.

Motors and control

Plants of this type require a large number of small motors which, in so far as practical, are served from 440-volt circuits even in the fractional-horsepower sizes. In this plant as much of the load as possible is supplied directly from 440-volt distribution switchboards. Small single-phase motors for special operating conditions and electrically operated office machines are supplied from the 115-volt lighting circuits and a special 115-volt, d.c. motor-generator set respectively.

Complete control of the various processes is facilitated by the use of individual motor drives and automatic motors and solenoid-operated valves, meters and pyrometers. Water-tight pushbuttons and control equipment are used throughout the plant on account of the conditions previously described.

Typical of the planning which has made possible greater convenience and lower labor costs is the co-ordination between the operation of the power plant and the milk plant secured by means of an automatic call-and-answer system which can be extended to other sections if required some time in the future. The power plant consists of a boiler room and a compressor room, arranged so as to permit efficient operation with only one operator per shift. In the compressor room pumps for supplying ice water, hot water, cooling water and condenser water for the plant are arranged in groups of four, a total of sixteen pumping units being installed in this room. Each pumping unit is driven by an individual motor with the control button mounted at the motor itself. Each group of pumps is connected to three separate headers for supplying the various plant units.

Instead of running the control circuits of the pumping motors to the various points of use, co-ordination between the power plant and milk plant is secured by means of an automatic call-and-answer system. When the plant operator wants to start a pump he presses a pushbutton which lights an indicating lamp and sounds an alarm in the compressor room. The operator there starts the required pump, and when pressure in the header is built up to a certain point a mercoid switch automatically returns the indication to the plant operator by means of an indicating lamp on the operating floor. This centralized operation simplifies both the electrical control and the mechanical layout of the various water services as well as economizing on pump equipment and also enabling one operator to control the entire pumping operations for the plant.

The connected load consists of approximately 700 hp. in motors and 176 kva. in lighting, the maximum demand being approximately 353 kw. Because the daily load is comparatively large during the period from 9 p.m. to 12 noon and comparatively small between 12 noon and 9 p.m. and because the average power factor is 77 per cent the power rate is comparatively low. Definite economies have been made possible by the centralization of activity in this modern plant as compared to operations carried on in small separated units. However, modernization, to be wholly effective, must take into consideration not only the physical merger of facilities but also a carefully planned design of each particular unit of a plant in relation to its entirety. This plant illustrates the manner in which actual power costs may be reduced and plant operating convenience and savings effected by such co-ordination.

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Lamp Inspections Prevent Ill-Advised Economy of Light

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Lighting Sales Department,
Commonwealth Edison Company, Chicago

For some time regular commercial and industrial lighting salesmen have been assigned blocks in their districts in which they were expected to call on every customer to tell them of the advantage of using the proper size lamps and also of filling empty sockets and renewing burned-out lamps. In this way the entire city has been covered. For the year 1932 more than 67,000 lamps were renewed. During the first six months of 1933 3,513 orders for a total of 31,158 lamps were secured. This was an average of 8.8 lamps per order and resulted in reclaiming 512 kw. load.

Our department has arranged to be notified whenever a customer desired to replace present lamps with smaller ones. By reaching the customer before the lamps were delivered we have often been able to show him the harm he is doing his business by reducing the amount of light used. We point out that the saving is on the low rate and, therefore, small in proportion to the total bill.

Many large stores, hotels, clubs, and the like, thought it necessary to reduce their lighting bill, but hesitated to reduce lamp sizes without our advice as to where this could best be done. We carried out very complete surveys, reporting on lamp sizes used in individual departments, foot-candle intensities and conditions of walls, ceilings and lighting equipment including showcase, stock room and window lighting. A check was also made on circuit and riser capacities and on socket voltages. We pointed out in efficiencies in their present system, showing how they were wasting money for electricity used for lighting when their fixtures were dirty, walls and ceilings too dark, improper types of lamps used, lamp voltages incorrect, fixtures inefficient. Where an excessive amount of light was being used we did not hesitate to tell them about it. This was found to be the case in most stockrooms where we found the majority of lamps left burning all day with little use made of the space. When their standards of lighting were below those of their competitors we told them about this also.

Almost invariably these surveys have resulted in relighting jobs, with a considerable increase in wattage in some cases, these merchants and building owners being convinced that good lighting is an asset. In one case one of Chicago's largest merchandising establishments relighted its main floor with a system of indirect built-in lighting which resulted in an increased load of more than 100 kw. It also replaced obsolete showcase lighting equipment on this floor with an up-to-date type of reflector using 25-watt T-6½ lamps to replace the 15-watt F-10 lamps formerly used. More than 10,000 F-10 lamps used in the showcases are being replaced with 25-watt T-6½ lamps.

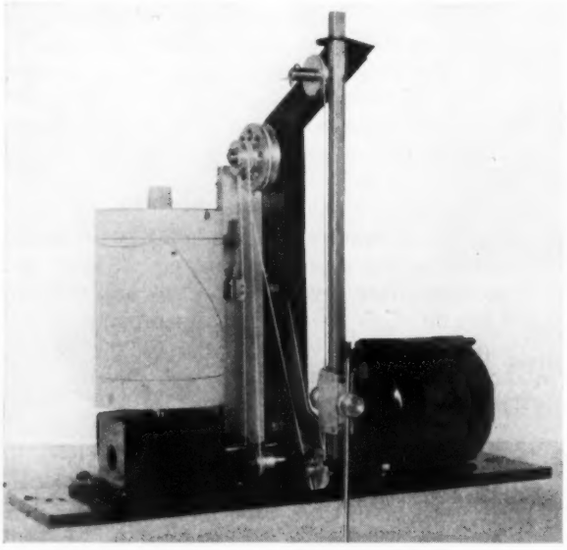
**From paper before the Illuminating Engineering Society.*

Curve-Drawing Device Tests Oil Breaker Travel

By M. S. SCHNEIDER and S. GOLDSMITH

Electric Operating Department,
Union Gas & Electric Company, Cincinnati, Ohio

Check of the electrical condition of an oil circuit breaker can be easily obtained with available equipment, but it has been difficult to determine whether a particular unit is properly adjusted mechanically, and the correctness of adjustments has been dependent upon the skill and experience of the workman. A partial check on the mechanical condition which is used extensively is to "time" the opening and closing operation by means of a synchronous timer.



Analyzer of circuit breaker mechanical operation

A drum of suitable dimensions is driven at a constant speed through reduction gearing by a small synchronous motor. A pencil, bearing against a chart on the drum, is fastened to a guide operating on a square vertical shaft and is caused to move up and down through a reducing motion. This, in turn, derives its motion from a rod attached directly to the lift rod of the oil circuit breaker. The rotary motion of the drum as driven by the synchronous motor thus gives time in cycles as abscissa on the chart, while the ordinate of the chart represents travel of the oil circuit breaker contact mechanism. The reducing motion is necessary to obtain a small, compact device and its use is also desirable in order to obtain a curve of suitable horizontal and vertical proportions. On the device now being used one cycle of time is represented by 0.77 in. on the chart and one inch of contact travel by 0.5 in., or, in other words, a two to one reducing motion is used. The device weighs 32 lb., is 14.5 in. high, 9 in. wide and 15 in. long over-all. The drum carrying the chart is 4 in. in diameter and rotates at 225 r.p.m.

This method involves so many variables that the results so obtained are of questionable value. A device which eliminates many of the objectionable features of former methods for testing has been constructed by the Union Gas & Electric Company. Its design and construction are apparent from the accompanying illustration. This device draws a curve of the opening and closing stroke so that the action of the oil circuit breaker at any portion of the travel may be seen at a glance. It is mounted in a suitable place on the center pole of the oil circuit breaker.

A drilled and tapped plug is removed from the top travel stop and a quarter inch rod is inserted through the opening and screwed into the stop on the top of the lift rod which carries the contacts. This rod is then clamped to the main slider of the travel device. A paper is fastened around the drum and is secured by a gummed end. The motor is started and a "zero" line is drawn on the chart with the breaker in the open or closed position. With the drum still rotating, the breaker is tripped or closed, and, after it has come to rest, the motion of the drum produces a "full travel" line. These two lines show the limits of travel and the motion of the oil circuit breaker mechanism will have traced a curve between these two limits. The drum is then removed and the chart cut vertically at the beginning of motion. This point on the resultant chart may occur at any point on the cylinder of paper.

The joint where the paper was fastened does not present any objectionable features in the record, even though it should occur in the center of the chart. The workman then takes the chart and lays a transparent template over it. This template carries complete information as to the allowable tolerance in adjustment of contact separation, speed, total travel, and rebound. If the curve as obtained falls within these limits, the adjustments are considered to be correct. If it does not, the form of the curve indicates just where adjustments are necessary.

The final curve on each oil circuit breaker is then sent in to the department head, along with the regular maintenance and overhaul report. The device has proved particularly useful when equipping older style breakers with modern types of interrupting devices. Frequently, these devices impose conditions on the mechanism different from the original equipment and require adjustments which can only be made either with the aid of an oscillograph or some such device as described in this article. This is particularly true with the lighter types of contacts and with the high-speed types of oil circuit breakers.

▼

Erosion Tests of Turbine-Blade Materials

Erosion of low-pressure blading in turbines is important not only because of its influence on efficiency, but on account of the expense involved in blade repairs. Satisfactory results can be obtained with high blade speeds, asserts C. R. Soderberg,* by protecting the back of the inlet edge with shields having a hardness in excess of 500 Brinell. Stellite has been found to be one of the best materials for this purpose, he declares. Low-pressure blading can now be operated at top speeds in excess of 1,200 ft. per second with intensities of erosion no worse than formerly obtained with conventional blades at 900 ft. per second.

Erosion Tests of Different Blade Materials at Tip Speed of 1,000 Ft. per Second

Specimen	Material	Approx. Hardness Vickers Brinell	Length of Test, Minutes	Loss of Weight, Per Cent	Loss per Minute, Per Cent	Comparative Erosion Resistance
H1 H2	12 Per Cent Cr. steel with Stellite shield	600	30	0.9	0.030	6.3
I1 I3	12 Per Cent Cr. steel	225	20	3.8	0.190	1.00
J1 J2	Tantalum	150	8	2.7	0.337	0.56
K1 K2	5 Per Cent Ni steel	172	4	1.7	0.425	0.45
L1 L2	Nitralloy	200–900	11	1.0	0.091	2.10

**Manager turbine division, Westinghouse Electric & Manufacturing Company.*

Water-Heating Characteristics Checked for Off-Peak Operation

Puget Sound Power & Light Company makes exhaustive analysis of water-heater design and operation to determine the most satisfactory combination for its off-peak rate

By GEORGE M. PALO
Puget Sound Power & Light Company

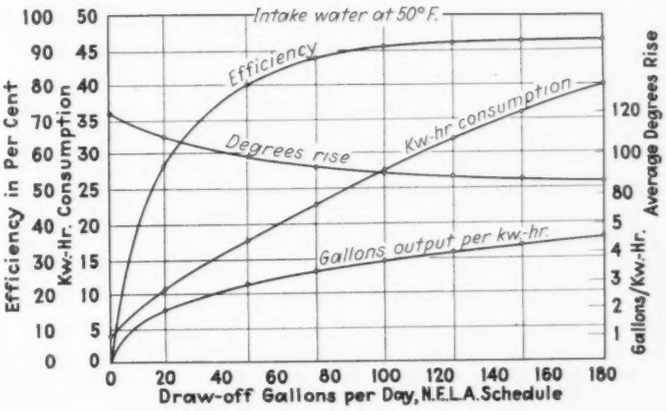
WHILE it is generally agreed that water heating offers the electrical industry a large and profitable potential load, there is little unanimity as to the rates and types of heaters which would best promote its growth. Before filing its recent schedule offering an 8-mill rate for off-peak water heating the Puget Sound Power & Light Company made tests on various types of water heaters to determine the design which would be most satisfactory both from the service and operating standpoints.

To be satisfactory for a consumer the water heater should be of minimum size for the service desired, highly efficient, capable of meeting the varying hot water withdrawals, inexpensive to operate and pleasing in appearance. From the operating standpoint the water heater should have a minimum of diversified demand on the power system's facilities and a good load factor. Having tentatively decided that water-heating service could be supplied economically only if such demands were eliminated from its peak hours of 3:30 p.m. to 7:30 p.m., the company based its investigation on the following premises. Small flat rate heaters continuously on the line were costly to the producer and unsatisfactory to the consumer. A large unit on intermittent service gives better service, but places inordinately high demands on the system and is impractical also from the standpoint of first cost. Because the average home is equipped with a 30-gal. tank, which prospective buyers might be reluctant to discard, a strong sales incentive would be provided if this tank could be adapted to satisfactory off-peak heating service.

The investigation was carried out using the data on hot water consumption as compiled by the National Electric Light Association. As reported, the average consumption of hot water in the United States is 10 gal. and the maximum 16 gal. per person per day. On the basis of the average family of 4.3 persons, maximum, normal and minimum days must provide for a hot water draw-off of 75, 50 and 20 gal. of hot water respectively. (See Table I for draw-off schedule.) Under normal conditions there should be 13.4 normal, 5 maximum and 12 minimum days during each month.

Assuming the average conditions, the satisfactory water-heating installation must be capable of providing 75 gal. of water daily which will be above the minimum usable temperature of 120 deg. F. The problem is to determine the tank and heater size which will so operate without impressing undesirable demands on the system's facilities. In order to have good load factor and prevent a new peak from being added to the system it is necessary to use a small heater. However, if the tank is drained of hot water, the small unit will not give satisfactory service because of the time required to bring the water up to usable temperatures. Apparently the solution is the addition of a booster unit controlled by a separate thermostat, the small unit being used to take care of intermittent demands on the tank, with the larger unit assisting during periods of heavy withdrawals. With a 750-watt base unit heater and a 1,500-watt booster unit it was calculated that a standard 30-gal. tank would be capable of delivering the 75 gal. per day of hot water.

Tests were made on assemblies using clamp-on heat-



Average performance of tank sizes in relation to the daily hot water withdrawals

Both the efficiency and gallon output per kilowatt-hour increase rapidly up to the 120-gal. day, but as the draw-off increases the average water temperature decreases.

Table I—Draw-Offs Based on N.E.L.A. Schedule

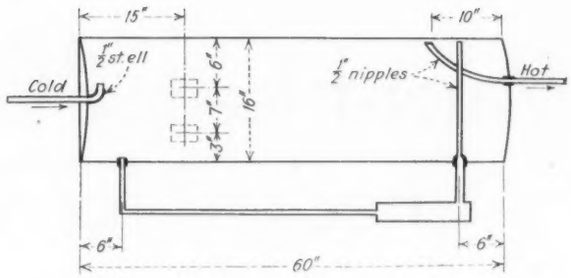
Time	20-Gal. Day	50-Gal. Day	75-Gal. Day	100-Gal. Day	120-Gal. Day	150-Gal. Day	165-Gal. Day	185-Gal. Day
6:00 a.m.	..	8	8	10.7	12.8	16	17.6	19.8
7:00	3	4	4	5.3	6.4	8	8.8	9.9
8:00	2	2	13	17.3	20.8	26	28.0	32.0
9:00	2	3	10	13.3	16.0	20	22.2	24.6
10:00	..	3	10	13.3	16.0	20	22.2	24.6
11:00	2	3	3	4.0	4.8	6	6.6	7.4
12:00 noon	3	3	3	4.0	4.8	6	6.6	7.4
1:00 p.m.	1	5	5	6.7	8.0	10	11.0	12.4
5:00	..	2	2	2.7	3.2	4	4.4	5.0
6:00	1	3	3	4.0	4.8	6	6.6	7.4
7:00	2	4	4	5.3	6.4	8	8.8	9.9
9:00	4	..	..	....	....	..	....	....
10:00	.	10	10	13.3	16.0	20	22.2	24.6

ers, insert heaters and side-arm circulators and factory units of the insert, inside circulator, side-arm circulator and automatic control circulator types. Heating characteristics, maximum draw-offs and standby or idling losses were obtained from each of the above combinations to determine which had the most satisfactory over-all characteristics.

In making the tests water entering the tanks was measured by a standard water meter. To obtain accurate information on the heating characteristics of the various combinations of heaters a special tank having nine thermometer wells placed 6 in. apart down one side was used. Thermometers also measured incoming and outgoing water temperatures; the temperature of the hot water was taken at the start and the finish of each draw-off as it was being discharged into a wooden barrel for weighing and obtaining the mean temperature of the run. To obtain a record of the energy consumption of the base-unit heater and the booster heater a watt-hour meter and a recording ammeter were inserted in their respective circuits with a recording voltmeter providing a graphic picture of the voltage at all times.

Preliminary tests made it apparent that the location of the heaters, the points of application of the hot and cold water pipes and the location and setting of the thermostats were of vital importance to tank performance. Subsequent studies were made to determine the most effective types and arrangements of heaters and tanks. To make the thermostat settings uniform in all tests the booster thermostat was set to cut off at a water temperature of 150 deg. and the base unit when the top temperature reached 170 deg., this being the maximum allowable temperature above which alkaline deposits begin to collect inside of the tanks and pipes and around the elements themselves.

Clamp-on Heaters—Two combinations of clamp-on heaters were tested, the first with the 750-watt base heater 4 in. from the bottom of the tank and the 1,500-watt booster unit installed midway between the top and bottom and the second with the base heater 12 in. from the bottom with the booster unit 20 in. from the top. Of the two, the second combination was superior both in efficiency and draw-off characteristics. With the booster heater located near the top of the tank the water in the top of the tank heats up much faster, which lowers the time of operation of the booster unit and increases the recuperation characteristics of the tank. With the first combination the tank would be capable of giving relatively large amounts of warm water, but very little hot water when subjected to the 75-gal. draw-off schedule. This combination also requires more energy as the booster unit operates a longer time.



This unusual scheme of connections was found to be the most efficient for the large horizontal tanks

Conclusions drawn from the clamp-on tests indicate that for a 30-gal. tank the booster unit should be located not lower than 20 in. from the top of the tank, as this combination barely came within the limits prescribed for the draw-off schedule. The minimum temperature of the draw-off water was 121 deg. F., only 1 deg. above the permissible lower limit. Furthermore, with the booster unit high up on the tank, the load factor is better as the base unit operates longer and the booster unit cuts out more rapidly, which also reduces the demand of the water-heating installation. From the customer's standpoint the second combination is preferable, giving more hot water per unit of energy consumption than the other arrangement.

Insert Heaters—In testing insert heaters three combinations were used. In all of them the 750-watt base heater was placed 6 in. from the bottom of the tank, with the location of the 1,500-watt booster unit inserted 30, 15 and 6 in. respectively from the top of the tank.

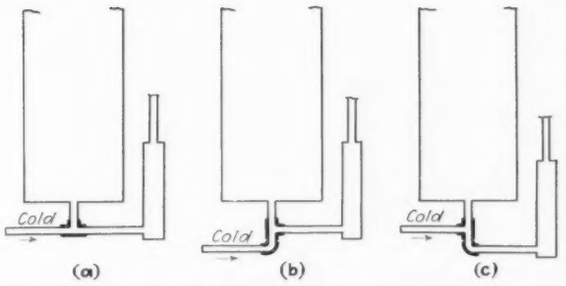
As might be expected, in the combination with the booster unit far down on the tank the characteristics were similar to those of the clamp-on heater located at the midpoint. Recuperation was poor and temperatures were low under conditions of extended draw-offs. The total energy consumption for a 24-hour period was 21.96 kw.-hr., of which the booster unit consumed 9.40. Under the 75-gal. draw-off schedule the minimum temperature recorded was 124.6 deg. F.

With the booster heater located at the other extreme, namely, 6 in. from the top of the tank, recuperation was

Table II—Performance of Side-Arm Circular Type of Water Heaters Operating on an 85-Gal. Day

Combination*	Minimum Draw-Off Temperatures for 85-Gal. Day	Energy Consumption Kw.-Hr. per 85-Gal. Day Base Unit	Booster Unit	Total	Remarks
Circulator connected to bottom of tank Riser enters 30 in. from top of tank	Would not carry 85-gal. day	.....	.....	.....	Unsatisfactory combination—Low draw-off temperatures with high energy consumption due to excessive use of booster unit
Circulator connected to bottom of tank Riser enters 20 in. from top of tank	124.0 deg.	13.05	10.72	23.77	Will carry 85-gal. day. Relatively inefficient. Excessive use of booster unit causes high demand
Circulator connected to bottom of tank Riser enters 15 in. from top of tank	122.0 deg.	14.34	11.33	25.67	Recuperation improved, but under extended draw-off temperatures become low
Circulator connected to bottom of tank Riser enters 6 in. from top of tank	124.5 deg.	14.02	12.11	26.13	Gradual improvement in characteristics continues as riser nears top of the tank. Efficiency is improving despite increasing energy consumption due to higher B.t.u. content of water drawn off.
Circulator connected 6 in. from bottom of tank Riser enters 6 in. from top of tank	124.0	11.51	10.51	22.02	Best connection. Combines low energy consumption with high draw-off temperatures and good recuperation
Insert base heater 6 in. from bottom of tank Booster heater in side-arm circulator connected to bottom and 6 in. from top of tank	122.0	11.83	10.71	22.54	This connection tested to determine practicability of adding side-arm booster unit to existing flat rate insert heater. Produces satisfactory but not particularly efficient results.

*Base heater 750 watts. Booster heater 1,500 watts



Plumbing connections tested to minimize the bypassing of cold water proved (c) to be most effective

almost instantaneous, and even if the tank were drained 3 gal. of hot water would be available almost immediately. Under continuous draw-offs the tank delivery would break down, and even under the test schedule the minimum temperature recorded was 118 deg., 2 deg. under the permissible minimum. This condition, however, occurred only once during the test period, the other draw-offs being well above the low figure. The energy consumption on this combination was the lowest of the three, as might be expected from the rapid heating at the top of the tank, which acts to cut the booster unit out after a short period of operation. A total consumption of 19.91 kw.-hr. was measured for the 24-hour period, the booster unit consuming 5.30 kw.-hr. It is of interest to note that the base unit operated 19½ hours out of the 20 hours allowed under the off-peak schedule. Under such conditions the demand is reduced to the minimum and the load factor is extremely good. This combination, with its relatively low consumption, is attractive to the consumer and, in cases where the hot water demands are not quite as large as the average, would be the best installation for both the consumer and the utility.

The combination with the booster unit 15 in. from the top of the tank struck the happy medium between the two preceding cases. In some respects it is superior to both and, as the following data show, probably is the most satisfactory for the average consumer. In the first place this combination combines rapid recuperation with the ability to withstand continued draw-off, successfully meeting the schedule of an 85-gal. day. On the 75-gal. day the minimum temperature recorded was 143.5 deg., on the 85-gal. day the minimum temperature was 129.5 deg., this combination being the only one of the three successfully to carry the larger schedule. Secondly, the energy consumption is but a little more than that of the most efficient combination, the total consumption being 22.41 kw.-hr., with the booster unit accounting for only 8.75 kw.-hr. of this total. Thus, the load factor is good and the demand low from this combination.

From this series of tests, it is apparent that care should be exercised in locating the heaters in the tank if a satisfactory installation is to be obtained. With the booster heater located too near the top of the tank hot water capacity is sacrificed for efficient operation. With the booster placed too far down the tank both efficiency and water temperatures are sacrificed to the rather dubious end of obtaining large amounts of warm water. With insert heaters the entire tank builds up as a unit. For example, if a tank is full of 150-deg. water and one-half of it is drawn off and replaced with 50-deg. water the entire tank will drop to a temperature of approximately 115 deg. and build up from that point.

Side-Arm Circulators—In the preliminary tests made on assembled units using side-arm circulators several points of importance were discovered. In some of the units the hot water riser from the heater entered the tank 6 in. from the top, in others it went directly into the top of the tank, and in still another it went directly into the hot water draw-off pipe. In some the circulation through the riser was further restricted by leaving but a small opening in the pipe just above the heater. The restriction in the circulating column was for the purpose of obtaining hotter water and thus helping recuperation. While this did produce hotter water and thus in a sense did help recuperation, when storage is taken into consideration this feature is not desirable, as the top of the tank will get exceedingly warm and the bottom remain cold or lukewarm. This is not desirable, for we do not want a small amount of exceedingly hot water, but rather a larger amount of usable water. Similar trouble was experienced with those heaters in which the hot water riser entered the top of the tank or the hot water draw-off pipe. The additional fittings required to bring the water into the tank served as restrictions, causing the water at the top of the tank to be very warm. Another point noted was that with the hot water riser entering the top of the tank or the hot water draw-off

Table III—Comparison of 30-Gal. Tanks on an 85-Gal. Draw-Off Assembled Units and Factory Units

Type	Description*	Time Top Temperature 42 to 120 Hr.	Min.	Radiation Loss Watt-Hr. per Hour	Minimum Water Temperature Deg. F.	Base	Kw.-Hr. Booster	Total	Total B.t.u. Drawn Off	B.t.u. Per Kw.-Hr.	Efficiency Per Cent
Assembled Units											
Clamp-on	Booster 20 in. Base 48 in.	2	3	132	121	11.87	10.93	22.80	68,100.0	2,995	87.5
Insert	Booster 15 in. Base 54 in.	1	3	181	129	14.22	10.57	24.79	72,800.0	2,940	86.1
Circulator	Riser Bottom To 6 in. from top	2	10	222	124	13.52	12.11	25.63	72,800.0	2,840	83.2
Circulator	Riser 6 in. bottom To 6 in. from top	1	48	182	124	11.41	11.26	22.77	65,724.0	2,890	84.7
Insert-Circulator	Base 54 in. Riser bottom 6 in.	2	15	244	122	11.83	10.71	22.54	64,002.0	2,840	83.2
Factory Units											
Inserts	Booster 12 in. Base 40 in.	..	..	122	123	11.69	11.17	22.86	70,400.0	3,080	90.2
Side-arm circulators	Riser bottom To 6 in from top	..	..	103	137	13.26	11.52	24.78	73,254.0	2,960	86.6
Automatic circulators	Units inside of tank	..	..	112	132	15.00	8.30	23.30	71,118.0	3,050	89.5

*Heater location in inches from top of tank.

pipe considerable bypassing of cold water through the heater was taking place.

Data on the operation of the various combinations of side-arm circulating water heaters is given in Table II.

The best combination was that in which the bottom of the riser was connected 6 in. from the bottom of the tank and the top connected 6 in. from the top of the tank. This connection is recommended where suitable outlets are available on the tank, with the alternative of connecting the bottom of the circulator to the bottom of the tank, the riser entering 6 in. from the top as before.

Because there are a number of small, flat-rate, insert-type units now operating which could be converted to off-peak operation with the addition of a booster, a test was made using a side-arm booster unit. While the results are not as good as could be expected by the addition of a second insert or clamp-on unit, the installation is entirely practical.

Factory-built and assembled units compared

To compare the performance of factory-built and assembled water heaters the tests made on each are tabulated in Table III. From this table it is evident that assembled units compare favorably with factory jobs both in draw-off temperatures and efficiency. Furthermore, any of the types of installation tested are suitable for off-peak operation provided proper heater locations and correct piping connections are used. It is of interest to note that each type of heater used has some features in its operation that are better than those of others. One may have a higher efficiency, another a higher draw-off temperature, another require less time or labor for installation, or have a lower first cost. Any of the eight installations tabulated would provide satisfactory and economical water heating under the off-peak schedule.

40- and 52-gal. tanks—Because many installations will require a tank larger than 30 gal., tests were made on 40-gal. tanks using 2,500 watts of heater capacity and 52-gal. tanks with 3,000 watts of capacity. Performance of the large tanks was similar to that of the smaller ones, it being possible to take a 130-gal. day from the 40-gal. tank and a 165-gal. day from the 52-gal. tank with a minimum temperature of 122 deg. Factory units delivered 165 gal. with a 4 per cent higher efficiency than the assembled units, one 50-gal. factory unit delivering 185 gal. of water a day, all at usable temperatures.

On the basis of the 30-, 42- and 52-gal. tank data, a curve was calculated showing the maximum draw-off that could be expected from still larger tank sizes. In computing this curve a maximum of 60 watts per gallon of capacity was used, with a maximum 5,000 watts for the 100-gal. tank. With this limit, the amount of hot water that can be obtained by increasing the tank size is limited by the ability of the heater to restore the tank to its original condition in the 24-hour period. Calculations indicate that the 150-gal. tank is the upper limit of tank size for a 5-kw. heater; beyond this less, not more, hot water can be expected if this sized heating unit is used continuously.

Thus far only vertical tanks have been considered. To determine the performance of the large horizontal tanks a series of tests on a 52-gal. tank, placed in the horizontal position, were made, using an outside circulating heater. Connections shown in the accompanying diagram gave the best results. In explanation of this unusual scheme of connections, the horizontal placing of the heater gave the lowest water temperature in the heater itself, better recuperation and less difference between top and bottom tank temperatures than any horizontal, vertical or inclined position. Despite the fact that its location seems to restrict circulation, this connection heated the entire tank evenly.

With horizontal tanks it is difficult to prevent bypassing cold water because of the small difference in height between the top and bottom of the tank. Cold water, introduced into the circulating column, would go through the heater to the draw-off pipe. The connection shown gave the least bypassing of any tried at both ends of the tank. The tests showed that the performance of a horizontal tank is very different from a vertical tank of the same size. Because of the larger temperature gradient in the former, thermostat locations and settings must be readjusted, and owing to the behavior of the tank during idling periods, the thermostats need not have more than 5 deg. lag for satisfactory operation. Because of the excellent results obtained with the thermostat location shown, much deviation from this arrangement is not recommended.

The horizontal tank is best suited for service where the draw-offs are small in quantity and frequent in number. It does not have the storage of the vertical tank and under extended demands will bypass cold water in spite of all precautions.

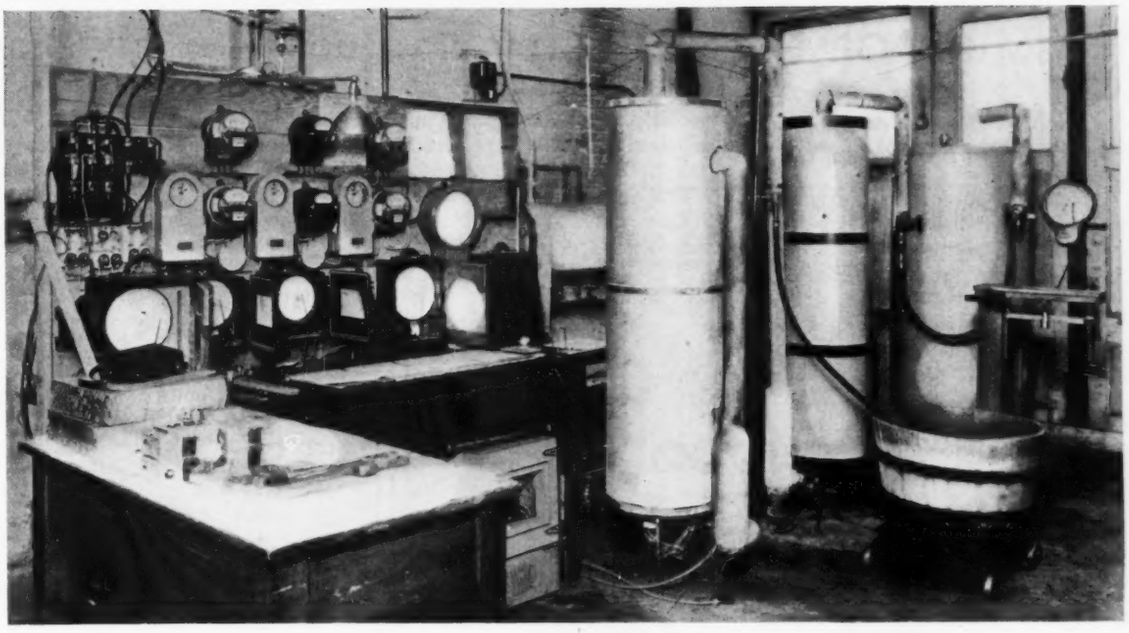
Plumbing Connections—Piping in a water heater installation is an important factor in good service. In equipping standard tanks with heaters, the type, location and connection must be considered. In instances where insert units are considered, with a tank not having the necessary holes at the right location, resorting to drilling and the use of spuds probably will cause a leaky connection due to the continuous heating and cooling of the metal around the heater unless welding is used in making the joint. Experience has shown that where drilling would be necessary, it is better to substitute another type of heater with the proper connections.

Pipe connections and thermostat position important

With side-arm units the best connection was shown to be that in which the bottom of the circulator entered the tank 6 in. up from the bottom. This eliminates bypassing cold water entirely and leaves a layer of cold water in the bottom of the tank, which reduces radiation losses. When the tank is not equipped for this connection the circulator may be connected at the bottom of the tank. In the accompanying diagram (c) proved by far the best of the three in eliminating the bypassing of cold water.

Another precaution for good service is the use of a heat trap in the draw-off line, which eliminates heating all of the hot water pipes in the house and the associated radiation losses. The heat trap is a simple "U" in the line and may be made from four elbows and three nipples.

Thermostats—The location of thermostats is very important and dependent upon several factors. It is desirable to have the base unit come on after small withdrawals, and as the base of the tank is the only place where an appreciable temperature change occurs, it is necessary to locate the thermostat controlling the base unit at the bottom. Also to obtain a good load factor by dividing the work between the base and booster units, the booster thermostat must be set to operate at a lower



Laboratory set-up used in the analysis of water heater performance

level than the base thermostat. If the booster thermostat were located at the same level as the base control it would operate first, and all idling losses would be taken by the booster unit. Consequently, to avoid this, the booster thermostat should be located at or above the center of the tank.

With clamp-on and side-arm installations the thermostats may be located in the same pockets as the units themselves. With insert units, due to inherent characteristics of this type of installation, the thermostats must be located above the units to prevent water in the top of the tank from becoming too hot before the energy is cut off. In this type of installation the preferred position for thermostats is directly above the units they control.

With this investigation an effort was made to limit the top water in a tank to 170 deg. After some experimenting, it was found that with the side-arm circulator setting the base thermostat for 160 deg. and the booster thermostat for 150 deg. satisfactory temperature control of the upper half of the tank could be obtained with efficient idling performance.

To follow tank temperature closely, the thermostat should be strapped to and have metallic contact with the tank. A proper thickness of tank covering is necessary to eliminate the effect of outside temperatures and drafts. Proper facilities for accurately calibrating the thermostats also are necessary for satisfactory operation and good performance.

Tank Covers—In off-peak heating idling characteristics are extremely important. For maximum economy and customer satisfaction the idling losses should not exceed the minimum monthly charge on the meter. With a bare 30-gal. tank and a side-arm circulator, the losses were found to be 1,000 watt-hours per hour with a temperature difference of 100 deg. To stay within the limit prescribed above, it was necessary to cut these losses to 175 watt-hours per hour, which meant providing a tank cover which was 83.5 per cent efficient.

Test losses on various types of covers varied from 180 to 335 watt-hours per hour. It appeared impossible to reach the desired figure without a prohibitory cost. Finally, by using a 2½-in., thirteen-ply paper cover, the top, bottom and all joints of which were sealed with hair felt, together with the 6-in. connection previously described, to the circulator and a 20-deg. lag on the base thermostat, the losses were reduced to the prescribed value. Asbestos was added inside and out to make the installation fireproof and the outer surface was neatly finished with a finishing paper and a fireproof lacquer. Such a cover is neat, durable, efficient and reasonable in cost.

Time Switches—Little need be said about the use of time-control apparatus. A time switch should be reliable and quiet operating and its motor connected ahead of the main fuses so that local trouble will not change the time of the operating cycle. The Puget Sound Power & Light Company uses a weatherproof sheet-metal cabinet which houses both the watt-hour meter and the time switch, an arrangement which discourages tampering and reduces wiring costs.

To answer the much-debated question as to whether or not the time switch control will add a new peak to the system at the close of the off-peak period, the experience so far has been that this is not the case, as it is seldom that the booster unit comes on immediately at the close of the period unless extended hot water consumption has occurred in the 4-hour off-peak period.

Questioned also is the relative advantage of the time switch control of the off-peak period over the use of a loading relay which automatically cuts the water heater out when the range load reaches a certain value. This company feels that the loading relay destroys the diversity of the range load, which is its greatest advantage, and consequently that the time switch control is preferable. Thus far the off-peak water heating of this company has created and is creating a desirable load without creating an appreciable strain on its distribution facilities and is practical both from the consumer and utility standpoint.

Men of the Industry

A. H. Schoellkopf Named Niagara Hudson President

Alfred H. Schoellkopf, formerly executive vice-president of the Niagara Hudson Power Corporation, has been elected president, and Paul A. Schoellkopf, formerly president, was elected to the new office of vice-chairman of the board of directors. Last week Alfred Schoellkopf resigned as president of the Buffalo, Niagara & Eastern Power Corporation, western New York subsidiary of the Niagara Hudson System (ELECTRICAL WORLD, September 30, page 448). He became identified with the electrical industry in the Niagara Falls region in 1915, after obtaining his education at Phillips Academy at Andover, Mass., and the Massachusetts Institute of Technology. At that time he joined the staff of the Niagara Falls Power Company and subsequently became vice-president and general manager. After Buffalo, Niagara & Eastern Power was organized he was elected a vice-president and in 1925 was named general manager. He also has served on the directorate of other utility and industrial companies in the Niagara territory. Mr. Schoellkopf served as president of the Empire State Gas and Electric Association for the 1932-1933 term.

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G. B. Buck New President Rocky Mountain Association

Gaylord B. Buck, general commercial manager for the Public Service Company of Colorado, was elected president of the Rocky Mountain Electrical Association at its annual meeting last month. Mr. Buck has been associated with Doherty enterprises for a number of years. Starting as a representative of the new-business department at Mount Vernon, Ill., he later became manager and subsequently was transferred to the City Light & Water Company, Amarillo, Tex., as new-business manager. In 1917 he joined the Durham (N. C.) Public Service Company in a similar capacity. It was in 1924 that he transferred his interests to Colorado to take charge of all new-business work in the domestic and commercial electric division of the Public Service Company.

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W. B. HEAD, JR., of Dallas, Tex., has taken over the duties of president of the Oklahoma Power & Water Company of Sand Springs, to succeed the late Chester O. Dunten. A Dartmouth graduate, Mr. Head has been associated with the Dallas Power & Light Company and the Texas Power & Light Company for the past seven years.

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Albert B. Tenney Retires

Albert B. Tenney, vice-president Charles H. Tenney & Company, Boston, and long regarded as one of the leading public utility operators in New England, has resigned from his executive and directorial connection with the properties under this management. Mr. Tenney is a native of Everett, Mass., and after graduation in mechanical engineering from the Massachusetts Institute of Technology in 1894 engaged in engineering work until 1900, when he became affiliated with the Suburban Gas & Electric Company, Revere, at the time of its acquisition by interests identified with his brother, Col. Charles H. Tenney. Beginning as superintendent, clerk and assistant treasurer, he advanced through various grades to the general managership and later presidency of the company, and as the Tenney organization expanded he served in executive capacities in the centralized house and in other utilities which came under this control. The history of the utilities serving the north Boston suburban area and territory centering in the lower Merrimac Valley under this grouping reflects Mr. Tenney's fine creative work over a long period of years. His mastery of engineering, commercial and financial detail, advanced ideas upon public relations, employee welfare and profound knowledge of rates have made him a foremost figure in utility circles in the northeast for more than three decades. As vice-president of the Massachusetts Electric and Gas Association he has exerted a powerful constructive influence upon legislative affairs in the Bay State. For many years he has been an active member of the directorates of a number of industrial and commercial organizations.

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OBITUARY

VANCE W. MILLER, 40, chief engineer of the Texas Electric Service Company with general offices in Fort Worth, dropped dead September 12, at his home. He was a native Texan and a graduate of Texas Agricultural and Mechanical College, where he received a B.S. degree in electrical engineering in 1914. Soon after leaving college he entered the employ of the Texas Electric Service Company, and was widely known in electric utility circles of the Southwest.

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J. P. MILLWOOD, chief chemist of the Okonite Company, Passaic, N. J., died at his home in that city September 24, after a year's illness. Mr. Millwood was well known for his activities in the work relating to rubber and electric wires and cables in the rubber division of the American Chemical Society and the American Society for Testing Materials. He had been connected with the Okonite Company as chief chemist since 1915.